SCIENTIFIC AMERICAN

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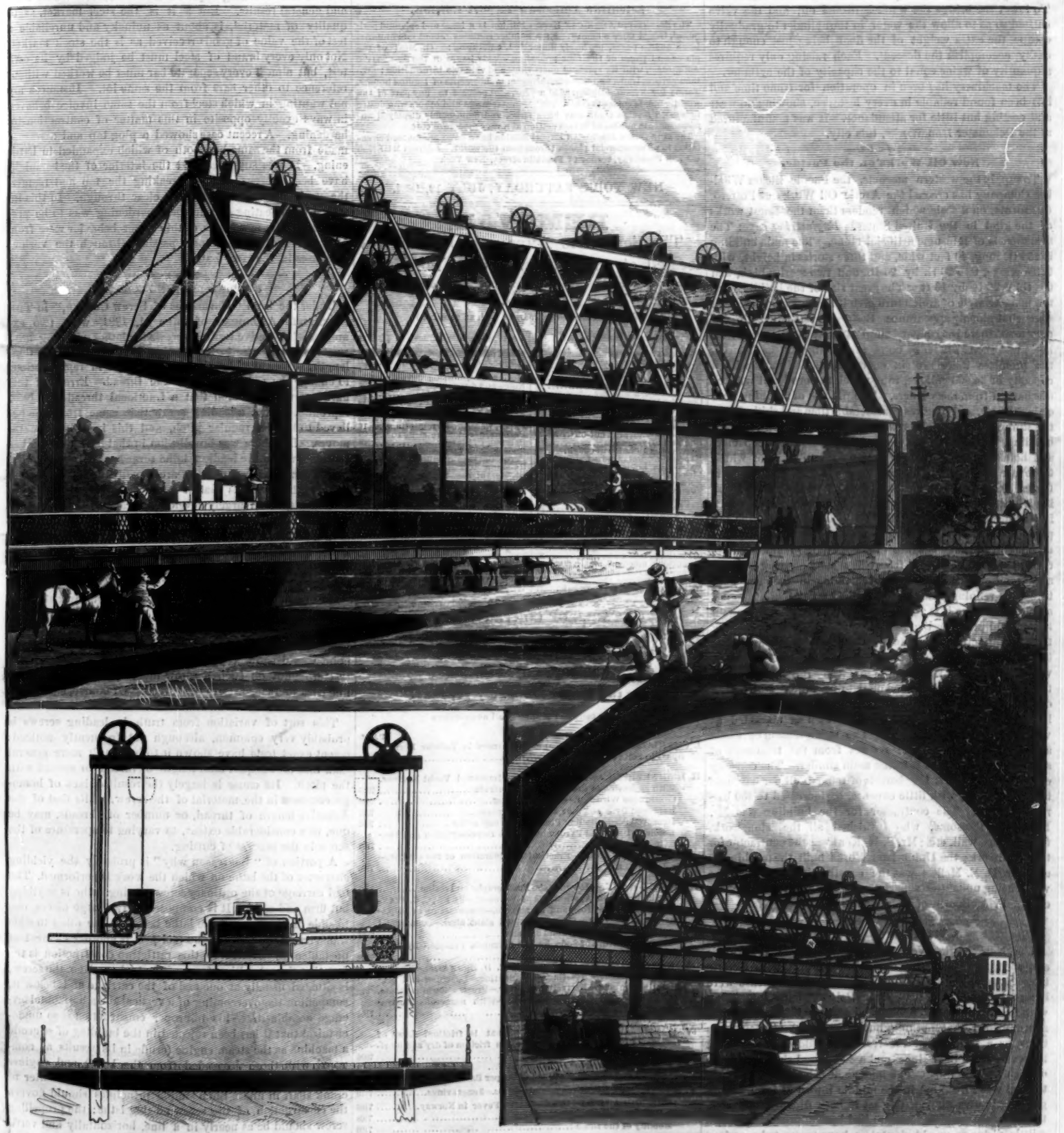
HYDRAULIC LIFT BRIDGE.

A short distance from the screw lift bridge which we illustrated in our issue of October 20, 1883, is the bridge shown in the accompanying engraving. It was built by the New York, West Shore, and Buffalo Railway, and spans the Oswego Canal at Salina Street, Syracuse, N. Y. Its construction was made necessary, as the line of the railroad changed the grade of the street.

In order to allow canal boats to pass, the floor of the bridge is lifted a distance of 9 feet, thereby increasing the head room just that much. The method of accomplishing this is simple in all its details, economical in working, effective in operation, and most decidedly novel. The floor system is nearly balanced by counterweights, the connecting ropes passing over pulleys placed in the superstructure. The power required to lift the floor is obtained from a cylinder, the piston of which is moved by water admitted from the city mains. The structure may be defined as a bridge elevated upon four end posts, and carrying a floor system which is moved vertically up and down in order to accommodate travel.

The bridge is 85 feet long, 38 feet 6 inches wide, and is placed at an angle to the canal of 33½ degrees. Two latticed trusses having inclined end posts are supported upon four latticed columns, one at each corner of the structure, and are connected together as shown in the engraving. Between the bottom chords of the superstructure is placed the water engine, with its axis perpendular to the center line of the bridge. The cylinder is 33 inches in diameter, the stroke is 5⅛ feet; the ports are 2½ by 11 inches, exhaust port 4 by 11 inches. On each end of the piston rod, which is 4½ inches in diameter, is a rack 8 inches wide, with 3 inch pitch.

Each of these racks engages with a pinion on a shaft 5 inches in diameter running parallel with the lower chords. The pinions are 24 inches in diameter, pitch 3 inches. At intervals on this shaft are pinions 39 inches in diameter, 2½ inch pitch, which engage with vertical racks working in bearings attached to the sides of the structure. To the up-



NEW YORK, WEST SHORE, AND BUFFALO RAILWAY.—HYDRAULIC LIFT BRIDGE AT SYRACUSE, N. Y.

per ends of these racks are attached suspender rods 1¼ inches in diameter; and to those are secured steel ropes ¾ of an inch in diameter, which pass over pulleys placed on the top chords. These pulleys are 42 inches in diameter, and are mounted on 8 inch shafts. To the inner ends of the ropes are attached long buckets which carry weights nearly sufficient to balance the floor, which is a plate girder system. The valve is an ordinary D valve, and the valve rod is so connected that it can be shifted from the ground. The inlet is connected with the city water mains, and although the pipe is throttled—the authorities being fearful of an excessive use of water to lift the bridge—the bridge can be raised in 15 seconds. A shoulder on the suspender rod rests on the lower chord of the overhead truss; this rod carries the dead load, the rope running over the sheaves carrying the live load. When the floor is down, its ends rest upon stone abutments.

Water being admitted to the cylinder, the piston is moved, the water pressure being amply sufficient to lift the unbalanced weight of the floor. The racks upon the ends of the piston rod, engaging with the upper side of one pinion, and the lower side of the other, move the pinions in opposite directions. The pinions upon the longitudinal shafts move all the vertical racks up, since the racks are so placed that the teeth of those in one row face those in the other. The arrangement of these parts is plainly shown in the sectional view. Thus the bridge is raised, the motion being regular and easy, the counter weights descending at the same time. To lower the bridge the water is turned off, and the valve shifted so as to allow the water in the cylinder to gradually escape, the extra weight of the floor being just enough to easily accomplish the descent. Each raising only requires a quantity of water equal to the capacity of the cylinder.

The machinery has been in operation for some time and has been found reliable in every instance, showing no wear and costing but little for attendance. It was manufactured at the Delamater Iron Works, this city.

New Oil Works on the Pacific.

To supply the western markets, the Pacific Steam Whaling Company has erected the Arctic Oil Works at Potrero, California, on a scale which renders them the finest works of the kind in the United States. *Engineering* says: The structure is of Ransome artificial stone. The main building is 150 ft. long, 40 feet wide, and three stories in height, with three wings, two 26 ft. by 26 ft., and two stories high, and the third 26 ft. by 16 ft. The great size of the building and the massive style of arcitecture give it an imposing although somewhat gloomy appearance. Besides the structure already mentioned there is a coopers' shop 24 ft. by 30 ft., two stories high, and sheds 155 ft. by 60 ft. for storing full casks. On the premises there are six enormous tanks, each with a capacity of 64,000 gallons, into which the crude oil will be discharged from the whalers. The process of refining is an elaborate one, and requires considerable time and skill. From the storage tanks the oil is carried through pipes to the main building, where it is run into tanks of 100 barrels capacity, and boiled; from there it is drawn so into pits—of which there are eight—each of 100 barrels capacity, where it is frozen by ice. When sperm oil is being treated, after freezing it is placed in bags and put under hydraulic presses, where it is subjected to great pressure. The first running from the press is called winter oil. The stearine or spermaceti remaining in the bags is again pressed, but the temperature is raised to 50 deg. The oil from this second pressing is called spring oil. The residue still remaining in the bags goes through a refining process, and is then taken to a hot room, at 85 deg., where it is again pressed. After this it is again refined and produces the spermaceti of commerce, or is ready to be manufactured into candles. The oil, as it comes from the presses, is put into vats under the roof, which is of glass, where it receives a sun bath, and is ready for the barrel and the market, under the name of natural winter and spring oil, as the case may be. Or else it is run into large bleaching tanks before being sunned, and then is marketed as winter or spring bleached oil. The manipulation of whale and fish oil differs in some respect from the treatment of sperm, but the process is in the main similar. The capacity of the new works is 150 barrels of refined oil per day, and this output can, with little expense, be increased to 250 barrels per day. The contractor for the building was Mr. Ernest L. Ransome, who furnished all the stonework, foundations, wall, etc.; Mr. S. H. Kent was the contractor for the woodwork; the Union Iron Works built the machinery, and Mr. D. E. Melliss was the constructing engineer; the whole being under the superintendence of the future manager, Mr. F. A. Booth, of New Bedford.

A Wild Cat Cannon Shot.

The New York, West Shore, and Buffalo Railway is equipped for eleven miles near West Point with electric block signals. Great precautions and large expense were incurred in order to pass West Point without interfering with the facilities for artillery practice, which was so far accomplished that nothing but a wild shot can touch the track or a train upon the track. A wild shot was fired, however, a few days since, and a 400 pound shot struck one of the 67 pound rails. The long angle fish plates broke, and the rail was forced out in the middle into a U form. Danger signals were immediately set in both directions by electric apparatus, which, if a train had been approaching within a little distance, would doubtless have prevented a serious accident.

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(Illustrated articles are marked with an asterisk.)

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THE SCIENTIFIC AMERICAN SUPPLEMENT

No. 445,

For the Week ending July 12, 1884.

Price 10 cents. For sale by all newsdealers.

CONTRACTION OF STEEL.

The hardening of cast steel, of the usual grades employed for tool purposes, generally contracts it. This quality in cast steel is frequently employed to reduce to exact size articles that must be hardened for their purpose. A machinist recently stated a rather unusual experience, that of rehardening six times a plug gauge in order to reduce it to size. At each hardening the steel was subjected to a close measurement test, and the successive contractions could be measured until the oversized gauge had been reduced to a size that required only the ordinary after-polishing. This quality of cast steel (contraction in hardening) is one that is generally accepted as belonging to the metal; but there are instances where expansion rather than contraction is to be expected from repeated heatings, hardenings, and annealings. So much difference, which is almost diametrical, is due largely, if not mainly, to the difference in the steel itself rather than to uneven heating and hardening.

Half of the published notices of the management of steel, whether common or unique, are given without the proper elements on which to form an opinion as to the behavior of steel under heat and in the bath. If workers of steel—cast steel, tool steel—would record their failure experiments as well as their successful experiments, we should sooner arrive at some reasonable way of treating steel, and the manufacturers would believe that the casting of steel was different from the casting of iron, and that its after-working required care enough to insure even and general results. But as it is, the steel market, as to quality of material, is about as unlucky and unreliable a test of the value of goods received as is the stock market. Not only every brand of steel must be judged by its own test, but almost every separate bar must be worked without reference to other bars from the same lot. Instances are not wanting in which steel from the same invoice behaved in ways exactly opposite in this matter of contraction by hardening. A recent case showed a plug tap and a reamer made from the same bar, both of which expanded in hardening. It was supposed that the interior of the bar might have been porous, but on breaking the tap and reamer, the steel appeared to be sound clear through. In this instance even heating and uniform hardening was to be presumed, as the specimens of this queer behavior were from a large lot of similar tools passing through the various processes in the same batch.

CUTTING LEADING SCREWS.

Under the head "Curiosities of Screw Cutting," in THE SCIENTIFIC AMERICAN of June 21, 1884, were two examples of defective leading screws for lathes, showing how they varied in aggregate number of threads in the total length, sufficiently, by cumulative errors in reproduction, to change the radical pitch of the thread. Errors of this nature are so common that a fractional thread has been reproduced from a leading screw that came from one believed to be of a regular pitch, and this in only three removes. But there was no allusion in that article to another serious error in the leading lathe screws and the elevating planer head screws, as they are usually produced on the lathe. This error is that of a defective thread, known to machinists, when largely developed, as a "drunken thread." A thread of this character is not a true spiral or helix, but twines about its core on a varying incline, sometimes—for a part of its revolution—moving at right angles to the core of the screw instead of on the incline demanded by the determined pitch of the thread.

On such a drunken thread a nut will not present a face perpendicular to the screw in all parts of its revolution, but at one point its face, if extended by a line across it, would show a dip below the horizontal, and at another point would show a projection above the horizontal. A "set-up" nut on such a screw must spring the bolt into line with its face, or strip the thread. Of course, such work is unmechanical and imperfect.

This sort of variation from truth in leading screws is probably very common, although not frequently noticed; recent exact tests have shown it to be a fault more general than that of unequal total length of thread to accord with the pitch. Its cause is largely the result of lack of homogeneousness in the material of the screw, while that of the defective length of thread, or number of threads, may be due, to a considerable extent, to varying temperature of the screw in the process of cutting.

A portion of "the reason why" is probably the yielding character of the lathe on which the work is performed. The tool carriage of the ordinary screw cutting lathe is anything but firm and solid. It is composed of two large pieces, one to slide on the ways of the lathe bed, and the other to slide transversely on it, while the tool post is another element of unstableness. Added to this rattletrap construction is the fact that the propelling force of the tool carriage, the screw, is situated usually at one end of the carriage and below it, compelling the overcoming of a vertical and a horizontal leverage combined. This improper construction is so unmechanical that it has been rejected in the building of so crude a machine as the steam engine (crude in its results as compared with those demanded from the lathe), and engines now must have the piston rod, the pitman, and center of crank shaft in line. Such simple principles should govern the construction of the screw cutting lathe; the propelling screw should be as nearly in a line, horizontally and vertically, with the tool carriage as is possible in construction, so that there shall be no invitation to "give" at a hard

place in the work, and no possibility of "winking" of the tool. As the screw cutting lathe is made now, it is a lathe of convenience, and is as well adapted to turning, drilling, and boring as to screw cutting. This should be abandoned for the method of building screw cutting lathes for that purpose alone. As they are now generally built, they are scarcely more accurate in the reproduction of threads than the old-fashioned hand lathe and the hand chaser.

A move has been made in the right direction for improvement in this department of mechanics in the construction of a lathe that avoids the faults of the ordinary screw cutting lathe and combines the requirements for an exact tool. The principle appears to be correct, and future improvements will probably be confined to those of details.

Instruction of Deaf Mutes.

A convention for considering methods of teaching articulation to the deaf was held in New York, June 25 to 28. More than 200 delegates were present, representing 38 schools. There were in the United States at the last census about 35,000 deaf mutes; there are 58 schools for their instruction, and 7,000 are being educated at public expense. The leading systems of instruction are the French method of signs and the German one of teaching speech and lip reading. The York institution was the first here to introduce the oral method as practiced in Germany, and thirteen schools have been recently established in which this method prevails, while nearly all the old schools now have special classes in articulation and lip reading.

Prof. A. Graham Bell presided at the convention, and Principal Greenberger of the New York Institution, gave an exhibition of reading spoken words from the lips with a class of a dozen boys and girls. The pupils were able to understand all words spoken to them, and even to repeat them. Dr. Gallaudet, President of the National Deaf Mute College in Washington, D. C., said oral instruction had been carried on there for five or six years. One pupil, who came to that institution six years ago, had no speech whatever, and they were obliged to teach him the simplest elements. At the end of four years and a half he spoke very well, and read from the lips of his friends, and even of strangers. One and a half years ago it was ascertained that he possessed a degree of hearing, that it was decided to experiment with. He then heard loud noises, but knew nothing of articulate sounds. His teacher made use of the speaking tube and very little use of the audiphone. Through their means the boy began to recognize articulate sounds, and his hearing developed until, within the last few months, he had been able to undersand conversation through a tube such as is used by persons who are not considered very deaf.

Such cases give encouragement to the belief that many who have heretofore been considered incurably deaf may yet have the dormant power, under proper treatment, of recovering sufficient hearing faculty to be practically useful. Prof. Clark of the Washington Heights Institution, N. Y., said that experiments made there showed that less than 25 per cent of the pupils were totally deaf, and of these a large majority were those who had lost their hearing by disease.

The convention was one of the most interesting in its proceedings as well as one of the largest ever held, and it is hoped that it will have good results in promoting the establishment of a training school for teachers of the deaf, with a curriculum to include the anatomy and physiology of the organs of speech and hearing; vocal gymnastics, speech reading, the elementary laws of sound, the methods of testing and developing latent hearing, English orthography and orthoepy in their special relations to the deaf, and the art of imparting a knowledge of articulate speech to the deaf and semi-deaf.

A Flame of Gas Eighty Feet High.

A measurement of the flame from the new gas well on the Westinghouse property has been made, and it is found to be eighty feet in height. It varies, however, with the condition of the atmosphere. The gas escapes from a six inch pipe seventy-five feet high, so that the top of the jet when the engineer brought his instrument to bear on it was 155 feet from the surface. A still, clear night makes every difference in the volume of the blaze.

The successful finding of gas at Pittsburg has stimulated other establishments to try and supply themselves with this valuable fuel. Two firms have already begun the drilling of wells, and four others will begin operations in a day or two.

At the Pennsylvania Tube Works the use of coal has been discontinued altogether. The workmen find the new fuel superior in its application to the manufacture of wrought iron tubes, and the cost is about half the old expense for coal and coke.

The Thermometer as a Pressure Gauge.

In view of the occasional unreliability of steam pressure gauges for boilers, Sig. G. Clodig proposes to use thermometers to replace or accompany them, in order that the record of temperature may serve as a check upon the record of pressure. The thermometer for this purpose would have a reservoir of iron for the mercury, which would be conveniently inserted through the boiler shell, so as to be in contact with the water. The tube, so far as it is contained in the boiler, would also be of iron, while its indicating prolongation outside would be of glass. The temperature of the water, by the usual law, would indicate the pressure of the vapor.

Foundations in Quicksand.

Mr. T. P. Hosegood, of the College of Practical Engineering, London, writes as follows to *Engineering:* Mr. MacAlpine, the eminent American civil engineer, when last in this country addressed the pupils of this college in explanation of some of the expedients adopted by him in his prolonged and extensive practice. One of these was a mode employed at Albany in the preparation of the foundation for the capitol. The ground on which the structure is built consists of a rather soft blue clay, which suffers considerable compression from any heavy weight placed upon it; to obviate any disturbance from this cause, Mr. MacAlpine first proposed to bore holes at equal distances in the clay, and to fill them up with sand, forming thereby sand piles, which were practically incompressible; but on further consideration it appeared to him that these piles might be dispensed with by taking the precaution to make the area of the foundation for every wall in the structure strictly proportionate to the weight which such foundations would have to sustain, so that the pressure per square inch of the foundations would be equal in every part; in such a case it was clear that though the building would sink somewhat, it would all sink equally, and so no damage would be done by the unequal settlement of the parts. This was the plan that was practically carried out, and it has been found to be in all respects successful.

A still more difficult problem than this, however, is how to place a heavy structure on a quicksand which swallows up everything. It is well known that the beds of Ganges and various other rivers in India are composed of quicksand, and the question arose in the construction of the East India Railway in what way a bridge could be carried across such a river, the bed of which is three miles wide.

The principal of this college, who was at the time one of the engineers of the railway, proposed a plan for the accomplishment of this object, which it may be useful to describe as a guide to others in similar cases.

The river, though 40 feet deep during the periodical floods, dwindles to a small and shallow stream at other times of the year. The greater part of the bed is at such times dry, and the small stream of water which remains in the dry season can easily be diverted. It was proposed to run a row of sheet piling of small depth and thickness across the river during the dry season, and another similar row 40 feet to 50 feet higher up the river, forming a belt, say 50 feet wide from side to side, on which belt the bridge was to be built. Perforated pipes were to be forced at short intervals into the quicksand, say to a depth of 30 feet or 40 feet, and through these pipes a solution of green vitriol was to be forced, which would convert the whole mass of quicksand to this depth into rock. There was a hill of green vitriol or iron barytes near at hand which could have been easily utilized for this purpose.

It appears to be a valuable suggestion, though so far little acted upon, to turn intractable soils into rock by the injection of an agglutination fluid, when the difficulty cannot otherwise be dealt with without great expense. Natural sandstones are thus formed by the infiltration of fluids containing either iron or lime, and probably a union of these substances would be preferable (as in Payne's process for preserving timber) to the use of either ingredients separately. The different fluids, however, in such case should be introduced through separate pipes, as if sent through the same pipes the opening would be promptly closed by the formation of sulphate of lime or gypsum.

The Lalande Primary Battery.

A considerable amount of attention has recently been directed to the Lalande-Chaperon-Spence primary battery, by means of which it is claimed that a current of electricity can be generated and used either for lighting or for driving machinery, and that certain of the elements which produce the current become converted during the time they are doing their work into a substance of greater value than before the battery was started. In other words, we have a battery which not only produces a good electric light, but puts money in our purses after it has done so. We have heard of such batteries before, and we have seen some, but the truth of the remarkable statements made respecting them has never before been so nearly and so clearly demonstrated as in the present instance. It of course remains for time to show whether the battery will prove commercially as well as scientifically successful; but as far as we have seen and heard, we cannot refuse to accept the favorable statements made respecting it. The battery is at present somewhat large, but this, we are told, can and will be remedied in future examples. That which we recently inspected at the office of Mr. Hugh A. Fergusson, of 31 Lombard Street, London, is composed of forty-eight cells, each 1 foot square, and giving a current of from 15 to 20 ampères, with the somewhat low electromotive force of 0·94 volt. The battery itself is capable of maintaining fifteen glow lamps of 10 candle-power each, or of driving a small motor. Each cell of this battery consists of an iron tray, on the bottom of which is placed the depolarizing agent, which is oxide of copper. Just above this and supported at each corner is a plate of zinc, the cell being filled with a solution of caustic soda. Under ordinary circumstances, and when the circuit is open, no action takes place between these elements; but on the circuit being completed the work of decomposition commences. The oxygen of the oxide of copper combines with the zinc, and forms oxide of zinc, metallic copper being left behind. When the battery is exhausted the zinc is recovered from the liquor in the form of an oxide, and this is stated to be 56¼ per cent more valuable than the metallic zinc, and is used for making paint and for other industrial purposes. This remarkable increase in value is said to be obtained by reason of the metal having gained 25 per cent in weight by its absorption of oxygen, and the oxide being also 25 per cent more valuable than the metal, weight for weight, thus giving a total increase in value of 56¼ per cent as stated. The oxide of copper is revivified, and can be used over and over again. The claims mainly advanced for this battery are, that it is absolutely constant so long as the elements in it are kept in a state of efficiency; that the action upon the zinc is very gradual; that while the light is not being used there is no waste going on; and that no noxious smell is given off, as is the case when acids are used. This latter point was clearly demonstrated upon the occasion of our visit, as was also the ability of the battery to give an excellent and steady light. A series of nine Woodhouse & Rawson glow lamps, each of 10 candle-power, were used in circuit. An Ayrton & Perry's motor was driven by the current, and showed the battery to be capable of doing good work in this respect.—*Iron.*

Rapid Assaying.

In the Assay Office it is a common thing to melt up foreign coin and assay it, preparatory to having it coined into United States money. The amount required to be assayed varies with the course of trade; when foreign gold flows in rapidly, the office is very busy. During the past four years the New York office has assayed about $300,000,000 of foreign coin.

Recently half a million dollars' worth of Spanish doubloons were treated in a day. The process is somewhat complicated. First the coins are weighed in the receiving room, and then they are sent to the melting room, where they are melted, cast into bars, and what are called slips are taken. These are small thin pieces of the metal, which are used to test the quality. The sample is rolled and hammered into a thin ribbon and stamped with the number of the deposit which it represents, when it is assayed to determine the proportion of gold, silver, and base metal. Having a portion of pure lead added to it, it is placed in the cupelling furnace, in which the lead quickly oxidizes by absorbing oxygen from the heated air that passes continually over the surface; this oxide carries away with it all the base metals which may be originally combined in the alloy, but leaves the precious metals. A beautiful "flash" is observed to take place on the surface of the metal at the moment when all the base metal is removed. Pure silver in the form of fine granules is added, and the alloy again cupelled. The resulting button is boiled in nitric acid, which dissolves the silver, leaving a small roll of pure gold. Weighings at the various stages in the operation determine the proportion of gold, silver, and base metals in the bullion.

The amount of pure gold varies in different coins. In United States coins the amount of pure gold must be nine-tenths. In doubloons the amount of pure gold is generally about 87 per cent. Of the remainder 9 per cent is silver and 4 per cent baser metals. The charge for assaying is about four cents an ounce.

Winding Wire Springs.

In winding an open spring of wire all that can be calculated on its reflex force after being "shut," or compressed, are the elements of material of the wire, temper of the wire, size of the wire, and diameter of the coil. These calculations are easily made, or so nearly that any error may be easily rectified, if the spring should not prove yielding enough, by stretching its coils apart. But a close spring is a different matter. In this there should be more than a closeness of coil; it is requisite that the closing-up inclination of the coil should be greater than the opening resistance, in order to get the greatest power from the spring. This condition may be obtained by holding the winding wire back toward the winding end, even if the leader is "off" from the open end; if the wire is strong enough to sustain the tension, as the result will be an apparently open-wound spring that is a closely coiled spring as soon as the end is released.

To increase the intensity of a spiral spring (close wound), the wire should be twisted in the winding, the direction of the twist being against the line of the pull on the wire.

Drying Oils.

A. LIVACHE.—The author finds that while an ordinary drying oil containing lead dries in 24 hours, a similar oil containing manganese dries under the same conditions in 5 to 6 hours. Copper, zinc, cobalt, nickel, iron, chrome, etc., prolong the time of drying to 36 to 48 hours. In practice he takes an ordinary lead oil, adds to it dry manganese sulphate in fine powder, and agitates for some time in the cold. The manganese is entirely substituted for the lead, and the oil obtained, freed from dregs by simple decantation, possesses an extreme drying power.—*Les Mondes.*

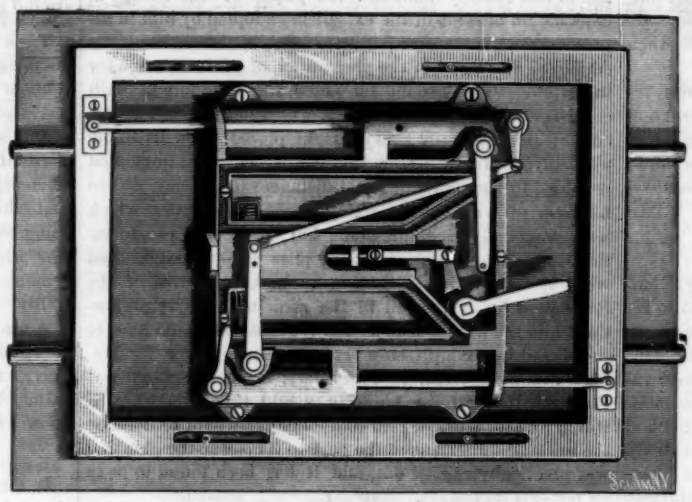
Rendering Paper Waterproof.

Labels may be fixed upon tin boxes, etc., exposed to damp by the following method: White of egg is diluted with one-half part water, and applied with a brush to the surfaces to be united. A hot iron is then passed over the paper, so as to congulate the albumen. By means of successive layers of paper and albumen, waterproof boxes, etc., may be formed. —*Cosmos les Mondes.*

PNEUMATIC LOCK.

In an invention recently patented by Mr. A. W. Fuller, of 84 Hamond Street, Boston, Mass., a casing is provided with two cylinders whose pistons move in opposite directions and are connected with a frame carrying the bolts. By means of compressed air, either piston can be operated, so that the bolts can be passed into or withdrawn from the apertures.

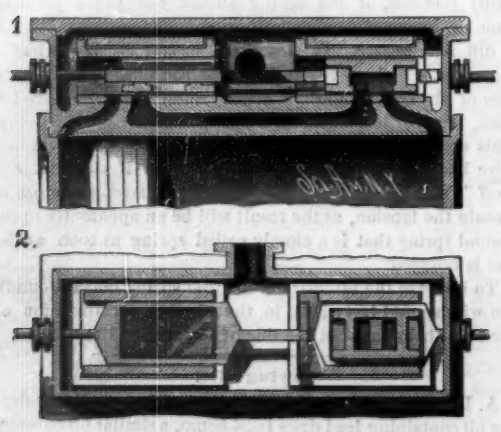
The locking case is held upon the inner surface of the safe door, and is furnished with an air compressing cylinder, the piston rod of which passes through a stuffing box in the end of the cylinder and is connected by a rod to a crank arm of a key shaft provided with a fixed or removable handle. At the top and bottom of the casing are formed two cylinders, whose piston rods project from the opposite ends of the cylinders and connect with the frame by bolts. Between the air compressing cylinder and the others are formed air chambers, which communicate with the central cylinder by valves; the closed end of this cylinder also has a port closed by an inside valve. The opposite ends of the outside cylinders are furnished with ports closed by valves connected with levers, as shown in the engraving. The cylinders have outlet ports and end ports, connected as clearly shown in the engraving. The operation of the device is very simple. The door is closed, and the upper valve is so adjusted that its cylinder will be in communication with the adjoining chamber. The compressing piston is then operated by means of the key or handle, the compressed air passes into both chambers and forces the upper piston outward, moving the frame in the same direction, thereby passing the bolts into the holes in the safe frame and locking the door in place. The piston will have passed the outlet port and allowed the compressed air to escape from the cylinder. When the safe is to be opened, the lower lever is operated by a key, or by a time lock or other device, and its valve is moved so as to permit the compressed air to pass into the cylinder, thereby forcing the piston and frame in the opposite direction, withdrawing the bolts. As it may happen that the upper piston will not pass the outlet port, and the compressed air will not be allowed to escape from behind the piston, there is arranged an end outlet port, the valve of which is opened from the lower lever as soon as the latter shifts the lower valve, thus permitting the compressed air in the cylinder to escape.



FULLER'S PNEUMATIC LOCK.

BALANCED SLIDE VALVE.

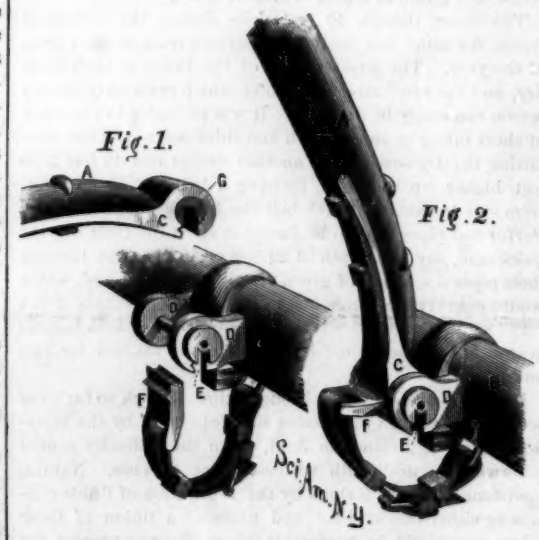
The slide valve shown in the accompanying engraving is constructed in such a manner as to lessen the friction and wear, thereby lessening the amount of fuel required to run the engine. Fig. 1 is a sectional side elevation, and Fig. 2 a sectional plan view. The valve is made in two parts, which are connected by a bar. The piston rod is connected with the parts by yokes passing around them, the sides being recessed to receive the yokes and allow the requisite play. The parts have recesses in their ends to increase the steam capacity of the steam chest, and have recesses in their lower sides for the passage of exhaust steam. Each part is placed in a valve box having close sides and top and open ends, and which is made of a length equal to the combined length of the part and its stroke. The height of the box is a little less than that of the valve chest, to form a steam space above the box, and the interior height of the box is a little greater than that of the valve, to form a space to receive a steel plate, upon the ends of which are formed upwardly projecting flanges that fit steam tight into recesses formed in the ends of the top of the valve box, so that no steam can enter between the top and plate. The steam pressure upon the upper edges of the flanges will hold the plate down closely upon the part of the valve, thus taking up the wear and preventing any downward steam pressure from coming upon the top of the valve, and causing the valve to work with the least possible friction. By this construction there will be very little wear upon the rubbing surfaces of the valve, and so the power required to work the valve will be reduced to a minimum. This invention has been patented by Mr. William G. Smith, whose address is 374 West Fifty-fifth Street, New York city.



SMITH'S BALANCED SLIDE VALVE.

IMPROVED THILL COUPLING.

The clip is formed with the cheek pieces, D, and with studs which retain the block of rubber back of the thill iron, C, to prevent rattling; the cheeks are also formed with inwardly projecting studs which constitute the pivot pin of the thill coupling, and one cheek is slotted below the stud, as indicated at E, and has a V-shaped recess formed in it. The thill iron has a slot and cavity which correspond in size and shape with those in the cheek piece, the slot being of such size as to fit over the pin of the clip. The form of the key for locking the clip and thill iron together is clearly shown at F. It is made concave upon its inner edge to fit the pin, and is formed with a loop at its outer edge by which it may be attached to the strap. The slot in the thill iron is inclined downward and slightly forward when the thills are held in working position, while the slot in the clip is inclined downward, so that the thill slot will stand in front of the other, thereby holding the key out of line with the cheek slot and absolutely preventing it from working out.



STRUCK'S IMPROVED THILL COUPLING.

To attach the thills to the clip, the thill iron is placed in the clip upon the pin, in such a position that the slots will be in line when the key is forced into the slot in the thill, when it will be held from edgewise movement by the tongue entering the recess. By raising the thill the key will be carried in front of the slot in the clip, so that all endwise movement of the key will be prevented by the cheek pieces. Constructed in this manner the coupling is simple, strong, and cheap, and while preventing rattling it is secure against accidental uncoupling.

This invention has been patented by Mr. Charles E. Struck, who may be addressed for further information, care of Messrs. J. M. Quimby & Co., 836 Broad Street, Newark, N. J.

A New Polar Expedition.

A new plan for a polar expedition has been submitted by several officers of the Russian Navy to the Minister, Admiral Shestakoff. Starting with the conviction that it is impossible to reach the North Pole by sea on account of the islands that surround the polar region, the Russian officers propose to start an expedition in sledges from the New Siberian Islands, which are 900 nautical miles distant from the goal. This space is to be covered by sledge parties, who would make depots of provisions in the newly discovered islands, and thus slowly but surely advance toward the north, securing at the same time the return journey of the expedition. When elaborated, the scheme will be submitted to the learned societies of Russia and the necessary funds raised, partly by subscription, though it is probable that, if the Government approves it, it will advance at least part of the expenses.

The Licht-Paus Process.

Herr Nickel, of Chemnitz, has a licht-paus process; the process is intended to reproduce by licht-paus, in blue lines upon a white ground, any kind of a drawing by using the well known licht-paus paper, which is sensitized by treatment with citrate of iron and ammonia, and red prussiate of potash. The process is based upon the production of a negative copy of the drawing to be multiplied, by using as follows a special licht-paus fluid: Take some filtered gum arabic and mix it with acetic acid, in order to render it fluid and prevent it from spoiling; then add a little dissolved soap, in order that the lines drawn by this mixture may not be brittle when dry. Add India ink to this mixture until a drawing made with it is quite visible. Make a copy in the usual way, with this ink, of the drawing to be copied, drawing upon the rough side of the ordinary paper. Then with the finger rub upon the same side of the copy as much common, soft, black chalk as the paper will take on. The chalk had better be previously pulverized. When all that has been done, the drawing is laid in water and then carefully rinsed. By this means the whole of the lines drawn with licht-paus ink dissolve out and disappear, leaving the drawing in sharp, white lines upon a black ground. If this negative copy is to be often used, it is recommended that it should be fixed by brushing it over with a broad hair pencil dipped in spirit varnish, or by coating it with a solution of gum arabic to prevent the black chalk from spreading over the white lines. When such a negative has been made, one may proceed to throw off an unlimited number of licht-paus pictures by means of the sensitive blue licht-paus paper, which gives blue lines on a white ground, by which a further carrying out of the licht-paus by means of colors is facilitated.

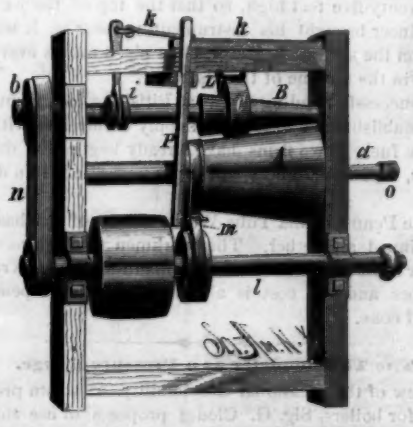
United States Patents.

Of the nearly 300,000 patents which have been issued by the Government, as shown by a table prepared by Commissioner Butterworth, 10,204 have been for metal working machines, 8,238 for stoves and furnaces, 5,505 for railway cars, 6,740 for mills and thrashing, 6,606 for harvesters, 6,686 for plows, 5,872 for applications of electricity, 5,060 for boots and shoes, 5,111 for steam engines, 5,254 for lamps and gas fixtures, 4,993 for laundry, 3,568 for seeders and planters, 3,504 for railways, 2,417 for wearing apparel, 2,429 for dairy utensils, 2,888 for fences, 3,418 for metaling, 2,453 for beds, 3,156 for pumps, 3,719 for water distributers, corset patterns have been 969 times patented, 754 machines for knitting, 734 nut and bolt locks, 1,219 methods of tanning hides, 884 fire escapes, 500 artesian wells, 440 bread and cracker machines, 1,580 chairs, 450 vegetable cutters, 567 fire engines, and so on, through a long list.

DEVICE FOR TRANSMITTING MOTION.

The engraving shows a simple and effective device for transmitting motion from one pulley to another so that the driving pulley, moving at a uniform speed, will operate the driven pulley at a variable speed without stopping the motion of the driver. It is applicable to all kinds of machines which must run at a certain, or different speeds, without regard to the speed of the motor. It can be easily applied to saw mills as they are now built, and the advantages it possesses when so used will be apparent.

The saw arbor, *l*, feed belt, *n*, gig belt, *m*, feed arbors, *a* and *b*, and the pinion, *o*, are arranged like those in the machines now built; but in place of the friction pulleys now in use, the parts, A, B, C, L, *i*, and *k*, are substituted. These, in connection with the lever, P, the upright handle of which is not shown, cause the shaft, *a*, to revolve in either direction, thereby moving the saw carriage forward or backward as desired. The carrier, L, extends through the frame, so that the operator may with his foot move the belt, C, to the right or left, increasing or decreasing the speed of the carriage as the log is carried up to the saw. The belt, C, is of somewhat greater length than is necessary to encircle the largest portion of the pulley, B, and is of such a thickness that it is firmly gripped by the pulleys at its passage between them.



LAIRD'S DEVICE FOR TRANSMITTING MOTION.

This invention has been patented by Mr. W. E. Laird, of East Calais, Vermont.

The Spider's Thread.

In a lecture at Boston, Mass., Professor Wood dealt with the phenomena of spider life. The female is larger and much fiercer than the male, who, while paying his addresses, is in constant peril, frequently losing some of his legs. In one tribe the female is 1,300 times as large as the male. The spider's thread is made up of innumerable small threads or fibers, one of these threads being estimated to be one two-millionth of a hair in thickness. Three kinds of thread are spun: One of great strength, for the radiating or spoke lines of the web. The cross lines, or what a sailor might call the ratlines, are finer and are tenacious—that is, they have upon them little specks or globules of a very sticky gum. These specks are put on with even interspaces. They are set quite thickly along the line, and are what, in the first instance, catch and hold the legs or wings of the fly. Once caught in this fashion, the prey is held secure by threads flung over it somewhat in the manner of a lasso. The third kind of silk is that which the spider throws out in a mass of flood, by which it suddenly envelops any prey of which it is somewhat afraid, as, for example, a wasp. A scientific experimenter once drew out from the body of a single spider 3,480 yards of thread or spider silk—a length little short of three miles. Silk may be woven of spider's thread, and it is more glossy and brilliant than that of the silkworm, being of a golden color. An enthusiastic entomologist is said to have secured enough of it for the weaving of a suit of clothes for Louis XIV.

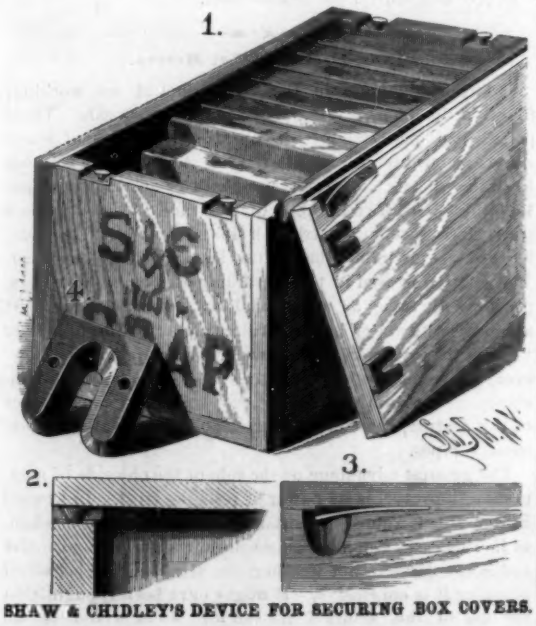
The New French Cruiser Sfax.

This cruiser, which was laid down at Brest eighteen months ago, was launched there recently. The Sfax, which is built of steel with twin screws and watertight compartments, is 290 feet long by 50 feet beam, and draws 23 feet of water, with a total displacement of 4,500 tons. The hull is entirely of steel, with a wood facing and a sheathing of copper. The vital portions of the vessel, such as the engines, boilers, and magazine, are protected by a deck with iron plates 2 inches thick. The Sfax carries six 6 inch guns, ten 5 inch guns on hydraulic carriages, and several revolving guns. Her two screws derive their motive power from two separate engines, which can develop at full pressure 7,500 horse power. The maximum speed is estimated to be 16¾ knots, and the Sfax will carry enough coal for a cruise of 6,200 miles. She has cost so far £153,000, of which about £80,000 has been spent upon the hull, and the remainder upon the engines, etc. If to this is added the expense of arming and equipping her, she will cost about £200,000.

DEVICE FOR SECURING BOX COVERS.

The body of the box is of ordinary construction, except that the end pieces are cut away at their upper edges, and that one of the side pieces is cut away to form the locking shoulder with which the free end of the spring engages for locking the cover in place. The outer surface of the side board is also cut away, to afford access to the spring for lifting it above the offset when the cover is to be removed. In the cutaway places are headed screws with which claw plates (shown detached and enlarged in Fig. 4), secured to the under side of the cover, engage to hold the cover securely upon the body. The screws stand flush with the upper edges of the end boards, so that when the cover is removed they will not interfere with the placing of a glass cover over the box for exhibiting the contents.

The claw plates may be stamped out of sheet metal, and secured to the cover by small nails or screws, or they may be made of cast iron. The spring is fastened to the cover,



SHAW & CHIDLEY'S DEVICE FOR SECURING BOX COVERS.

as shown in Fig. 1, and is so arranged that its free end will drop behind the offset just as the claw plates fairly receive the screws, thereby preventing all backward movement of the cover. The box is especially intended for the use of biscuit and soap manufacturers, who usually charge the boxes to their customers and have them returned to be refilled.

This invention has been patented by Messrs. H. A. Shaw and E. D. Chidley, of 784 Yonge Street, Toronto, Canada.

THE HARDEN HAND-GRENADE FIRE EXTINGUISHER.

Ever since P. T. Barnum, the renowned showman, brought to this country and attempted the general introduction of Phillips Fire Annihilator, about a quarter of a century ago, there have been a number of chemical fire extinguishers introduced, some of which have proved quite successful.

There has been recently introduced a very simple and inexpensive apparatus, called "The Harden Hand-Grenade Fire Extinguisher," and from the result of the numerous

HAND-GRENADE FIRE EXTINGUISHER

tests made before the public in this city, this would seem to fill a want not before obtained.

These little hand grenades extinguish fires on the same principle as the chemical fire engines, which are charged with carbonic acid gas, which by calculation possesses forty times the extinguishing effect upon fire that water has. These grenade extinguishers consist of a glass globe about four inches in diameter that resemble a small jug, and this contains the liquid which produces large volumes of fire extinguishing gas when brought in contact with flames.

The liquid it is said will stand a temperature of fifteen or twenty degrees below zero; thus all danger from its freezing and becoming useless when wanted is avoided.

A representative of the SCIENTIFIC AMERICAN was present at an exhibition trial of this extinguisher a few days ago, and witnessed the following experiments:

A fire was lighted at the side of a pine board fence, some 8 feet high by 15 long, the surface of which was coated with tar, and kindling wood and paper placed against it, the whole having a gallon or so of benzine scattered over it. The blaze sprang up almost instantly, and in less than half a minute the flames shot up twenty or thirty feet. To put out this fire, which it took but a few seconds to accomplish, three of the grenades were flung with enough force to break them and scatter their contents over the fence in the midst of the blaze.

Another trial was also made, in which the grenades were hung against the fence and the fire kindled under them. This time the blaze did not reach the height it attained in the former trial, but the grenades burst by the heat when the temperature had reached about 180° Fah., and the fire was again quickly extinguished. A watchman making the rounds of a factory with one or two of these in his hands would find them vastly more serviceable than a pail of water or a small hose, were either of the latter always on hand, as they so seldom are; and the grenades can be successfully used in cases where it is difficult to exactly locate or get near to a fire. To hang them in places where there is liability to fire, so they will burst before a fire has gained much headway, is one of their obvious uses.

For summer houses and stables, where the materials of construction are usually of an inflammable character and water is seldom at hand, these grenades would prove highly valuable. At the brewery of J. C. G. Hupfel a few days ago a fire broke out which promised to be more or less serious, but it was quickly extinguished by using four of the grenades.

An Ice-water Well.

In digging the well to supply the railroad tanks at Palouse Junction, W. T., the workmen passed through strata of alkali, clay, and finely-broken basalt rock, to a depth of 185 feet, where water of great purity and limitless quantity was found. The water in the well is five feet deep, and a steam pump, actively worked, makes little impression on the quantity. The most curious thing about the well is the fact that in digging the last fifty feet the workmen in the well had to wear heavy clothing and wrap their feet and legs in gunny bags to keep from freezing, while the men in the open air worked in their shirt sleeves. Water left in the bucket in the well over night would freeze. The water in the well does not freeze, because it flows too fast. The new well at Eltopia is seventy-five feet deep, nearly all the distance being through clay. The first twelve feet are through solid white alkali.—*Portland Oregonian.*

Intelligence of the Oriole.

On the western side of Central Park, very near 103d Street and Eighth Avenue, stands a row of elm trees, difficult to approach on account of a heavy growth of syringa bushes around them. On a branch of one of the trees, about sixteen feet from the ground, a pair of Baltimore orioles set to building a nest a few weeks ago. They chose the extreme end of the bough, with evident intention of making it a hazardous experiment for any bird nester to attempt to molest them. But in their excess of caution they appeared not to observe what the few persons whose eyes were keen enough to see the first labors of the little architects saw—that the branch was much too slender to support so large a nest as an oriole builds.

When the nest was about two-thirds finished the birds saw their mistake. The branch had bent so low that it was getting perilously near the grass. Work was at once stopped, and the builders sat close together for a long time, and seemed to be discussing the situation. Finally, they flew side by side to a bough about fifteen inches over the one on which their nest was, and, leaning over, inspected the distance. They seemed to be satisfied, and, though it was growing rapidly dusk, the birds flew away in opposite directions. In the morning it was found that they had firmly secured their habitation, and prevented the branch from bending lower, by passing a piece of white string, which they had found somewhere in the park, over the upper bough, and fastening both ends of it securely to the edges of the nest. The building then went rapidly on, and the orioles are now engaged in hatching their eggs. Very few persons have seen the nest, and there is a fair prospect that their skill and ingenuity will be soon rewarded by a brood of young orioles.

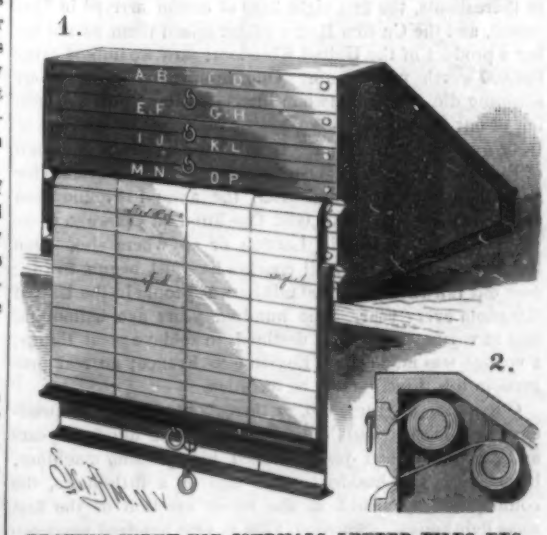
The Baltimore oriole is a very intelligent bird, but a New York ornithologist, who saw the nest, said he had never seen an achievement quite equal to this one before. He says the art of knitting fibers or strings together is well known to many birds. The weaver bird of India builds its nest out of a large, strong leaf, which it stitches together at the edges, making a compact and closely adhering funnel.—*New York Sun.*

Eucalyptus Globulus in Whooping-Cough.

The editor of the *N. E. Medical Monthly* having seen eucalyptus globulus recommended in pertussis, gave it a trial in his practice. He administered it in some twenty-five or thirty cases, and the results were of a very gratifying nature. Its effect was to greatly modify the severity of the paroxysms in every case, and in so abating the symptoms occasionally, that what gave promise of being a very severe attack in its incipiency turned out to be little more than what is known as a sympathetic cough. These results certainly merit for this agent a trial at the hands of other practitioners, for few will be prepared to admit that the best possible remedy for this affection has yet been employed.

INDEX FOR JOURNALS, LETTER FILES, ETC.

An index recently patented by Mr. Thomas C. Brown, of Norborne, Missouri, is conveniently arranged, and contains a great number of names in a very small space. The top of the box is inclined upward from the rear to the front, and is hinged to the back. The front is provided with a series of equidistant longitudinal slots, widened toward the outer surface to form grooves. As many spring rollers as there are slots are journaled in bearings within the case, and on each roller is fastened a sheet of strong paper muslin, to the outer edge of which is attached a slat fitting in the groove. Sheets fastened to the rollers, or pasted on the fabric, are



BROWN'S INDEX FOR JOURNALS, LETTER FILES, ETC.

ruled and divided into vertical columns, on which the names are written, with the corresponding page of the ledger, journal, etc. The initial letters of the names on each sheet are produced on the front of the corresponding slat. By pulling a slat the sheet is drawn outward so that the name and page number can be found; as soon as the sheet is released the spring roller winds it up again in the same manner that a curtain is wound on its roller.

England One Hundred Years Ago.

From an address delivered not long since by Mr. Thomas Ashbury, C.E., before the Manchester Association, we extract the following as to what was the state of affairs in England a hundred years since:

"We need not further consider the engineering works of the past ages, but come at once to the period of say about a century ago, or at all events the period when George III. began to reign (1760), and glance at the state of our own country at that time, the better to understand and appreciate the advantages and blessings of the present time.

"One hundred years ago England could hardly be called a manufacturing country, as we imported almost everything except corn, wool, and flax; iron from Spain, Germany, Sweden; pottery from Holland; hats from Flanders; silk from France; cloth and carpets from Belgium. One hundred years ago we had, as a country, fallen very low. Our cotton, woolen, flax, machine, etc., manufactures were struggling into birth; we could not keep the water out of our coal pits; we could not build steam engines; we could not build a church fit to be seen; we had no harbors or docks; we had no ships fit to go to sea; we had no literature worthy of our nation; we had our roads swarming with highwaymen. We had our army and navy composed of prisoners or pressed men captured openly; we had gibbets at nearly every cross road in the country; we had bribery and corruption of the grossest kind at Parliament elections; we had drunkenness, profligacy, and brutality, not only among the ignorant, totally neglected, common people, but also among the so-called upper classes; we had public abominations and obscenities that were not surpassed in the days of Nero; we had bull baiting, cock fighting, men fighting, dog fighting, badger drawing, and other coarse, ferocious, savage sports (pigeon shooting, unfortunately, still exists); we had the pillory, and men and women placed there for disgusting crimes, and crowds as foul as the criminals would pelt them with stones and rotten eggs, and horrid scenes were of common occurrence; we had women publicly whipped as well as men, and all feelings of refinement and delicacy were smothered in the licentious tendencies of the people; we had women and girls working down our coal pits; we had blasphemy, brutality, skepticism, irreligion, atheism, prevailing among all classes and causing the ships, the barracks, the works, the clubs, and even very many of the English homes to be turned into places of reveling and vice, disgracing the English name, and only worthy of the demon of darkness; we had, however, a few manly, plucky, brave men, who amid the darkness, drunkenness, and vice endeavored to educate, lift up, and arouse the people to a purer and more noble life; but these men fought against tremendous odds, for some of them were carried off by press gangs as sailors or soldiers, some were publicly whipped out of the town, and even in Salford the very first use made of the new town fire engine was to drench that noble, godly man, John Wesley, when he boldly and courageously 'bearded the lion in his den,' and publicly reproved and exposed the prevailing vices and iniquities of our sister borough.

"James Watt, while learning his trade in London, had to keep his house, and durst not walk abroad for fear of being seized and sent to labor as a sailor on our then 'floating hells,' or on our plantations in India or America. One hundred years ago there was in Scotland a veritable *slavery* class of colliers and salters, and it was only in 1799 that this was finally abolished. One hundred years ago the main roads in this country had ruts four feet deep in many places; in fact, one writer says the ruts were navigable; another says they were like the roofs of houses put together, and they had only just superseded the pack horse and bridle paths. One hundred years ago hanging was common for nearly all offenses; human life was little thought of. One hundred years ago or thereabouts, the first eight bags of cotton arrived in Liverpool, and the Custom House officer seized them as not being a product of the United Kingdom; now we import £60,000,000 worth per annum. One hundred years ago our shipping did not reach two millions sterling; now the sailing of our own and foreign ships runs up an average of forty-five millions sterling. In the year 1777 the borough of Liverpool bought up the revenue of its manorial rights for £2,330; one hundred years after, the annual revenue from the same source was £250,000! One hundred years ago there were no public docks in London or anywhere else. One hundred years ago the mail coaches had just begun to run; now our railways carry 700 millions of people in the United Kingdom every year. One hundred years ago ballooning was in vogue, and seemed destined to achieve great things; a voyage was made from England to France; no real progress in this direction can be recorded.

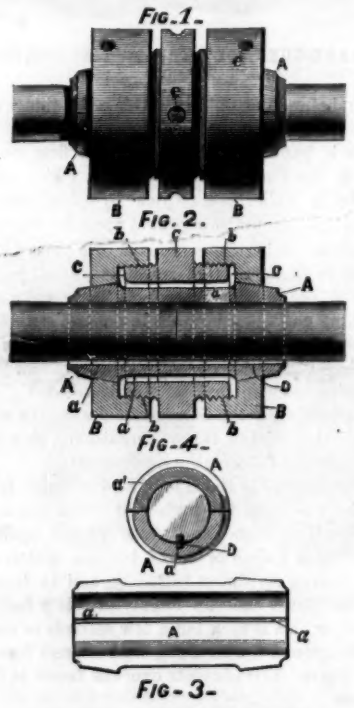
One hundred years ago, or thereabouts (1776), independence in America had been declared. One hundred years ago Arkwright had just invented his spinning machines, looms, etc. One hundred years ago or a little more, the country was astonished at the recent erection of the first *stone* lighthouse. (Smeaton, 1759.) One hundred years ago Watt had just invented the condensing steam engine. One hundred years ago Brindley had just finished his first great canal and Worsley tunnel. One hundred years ago England imported nearly all its iron, for Henry Cort only invented 'puddling' in 1788. One hundred years ago there was no gas or electric light, no high pressure steam engines, no steamboats, no telegraphs, no railways, etc. The working men of Lancashire one hundred years ago had precious little book learning, but an enormous amount of *brain* power. Many of the principal inventions were made by them and large fortunes was the result to some. They had great physical strength, could walk long journeys with heavy loads, and their fare was simple, generally milk, bacon, and some kind of oatmeal, one kind of which was thick and hard, and was called 'jannock,' since become in Lancashire synonymous with anything genuine and thorough. The goods were principally carried by packhorses. John Kay, of Walmsley, near Bury, the inventor of the 'fly shuttle,' made his escape from a riotous mob by being made up into a pack and carried away on the back of a horse. He died in Paris of a broken heart, guilty, like many other men, of having invented something for the good of Lancashire people, who turned against him for it.

"Tennyson has hymned the praises of our wondrous 'mother age,' and bids us remember how much better 'fifty years of Europe than a cycle of Cathay.'

"Every one can see the great contrast between the material condition of to-day and that which existed centuries ago. Take the last century or thereabouts; the merely material, physical, mechanical change in human life is greater than occurred in the 1,000 years, nay, even 2,000 years or more, that preceded it. In England this material change has been more rapid than in any other country, and is beyond parallel in the world's history. Yet the question has been asked in our times, 'With a thousand times the resources of any that preceded it, does it use them to a thousand times better purpose?'"

SHAFT COUPLING.

The engraving shows a device by which the ends of two shafts may be quickly and effectively joined. The bore of the two sleeve sections, A, is slightly smaller than the shaft



GOLDEN'S SHAFT COUPLING.

they are to embrace when they are put together. In one section the key seat, *a*, is formed. The sections are tapered toward the ends and provided with a slight recess, *a'*, to allow the central collar, C, to turn freely on them. This collar is provided with two circular projections, *c*, one having a right hand and the other a left hand screw thread, and is bored sufficiently large to slip readily over either end of the sleeve. The collars, B, are each provided with a conical shaped bore sufficiently large to closely embrace the tapering ends of the sleeve, and are formed with projections on the inside which have bores, *b*, threaded to correspond with and engage the threaded projections on the central collar. The collar, C, has four spanner holes, and the collars, B, two each.

After the collars, B and C, have been slipped over the ends of the shaft, the latter are brought together and the key placed in position. Then the sleeve sections are placed in position, and the collars, B, brought in contact with the central collar. By turning the collar, C, the collars, B, are drawn toward the center, and the sections are tightly pressed against the shafts, which they firmly hold.

This invention has been patented by Messrs. T. E. and J. P. Golden, and further particulars may be had by addressing Golden Bros., Columbus, Ga.

SLATE for roofing originally costs, per square, $4.50, and lasts at least 60 years; boards cost $2.00, and lasts 8 years; shingles cost $4.00, and last 12 years; corrugated iron costs $6.00, and lasts 20 years; and tin costs $6.50, and lasts 20 years. Making the average cost per annum as follows: slate, 7½ cents; boards, 25 cents; corrugated iron, 30 cents; tin, 32½ cents; and shingles, 33¼ cents. Making slate, without reference to other considerations than original cost and life, almost four times cheaper than boards, more than four times cheaper than corrugated iron and tin, and nearly five times cheaper than shingles.—*Slate Trade Journal.*

DECISIONS RELATING TO PATENTS TRADE MARKS ETC.

United States Circuit Court.—Northern District of Illinois.

CURRAN *et al* vs. BURDSALL.—PATENT LUMBER DRIER.

Blodgett, J.:

Where a patentee after selling all his rights under the patent and subsequently purchases an older patent to defeat his assignee's rights, *Held* that such proceeding is manifestly unjust and inequitable, even if the older patent clearly anticipates the patent for the device sold.

Where a patentee has sold all his right, title, and interest in, to, and under his patents and subsequently purchases an older patent, *Held*, that by such subsequent purchase an assignee cannot be dispossessed of the full benefit of what has been acquired from the patentee.

Where others are associated with the patentee in the purchase of a prior patent subsequent to a sale by the patentee of all his right, title, and interest in, to, and under his own patents, *Held* that the prior sale operates as a license as against all of the purchasers.

If others join with the seller in the purchase of the prior patent, such owners must look to the original seller for their compensation.

United States Circuit Court.—Southern District of New York.

THE ATLANTIC MILLING COMPANY vs. ROBINSON.—TRADE MARK CASE.

Wallace, J.:

The proofs show that in 1861 the firm of Alex. H. Smith & Co., then the proprietors of the Atlantic Mills, at St. Louis, Missouri, adopted the word "Champion," and employed it to distinguish a particular quality of flour made and sold by them. From that time until the present it has been used as a trade mark either by that firm or the several firms and corporations that became the proprietors of the property and business of the Atlantic Mills. The flour to which it was applied was particularly adapted for the Southern export trade, and became generally known and recognized as the production of the Atlantic Mills by the word which was thus used to designate it. The complainant has not made proof of any formal transfer by Alex. H. Smith & Co. to any of the succeeding proprietors of the Atlantic Mills of the right to use the trade mark, and if complainant has acquired that right it is because it passed upon the purchase of the mill property and business as an accessory thereof to each purchaser who became the proprietor of the premises, including the complainant, without any agreement respecting the trade mark.

The right to the exclusive use of a word or symbol as a trade mark is inseparable from the right to make and sell the commodity which it has been appropriated to designate as the production or article of the proprietor. It may be abandoned if the business of the proprietor is abandoned. It may become identified with the place or establishment where the article is manufactured or sold to which it has been applied, so as to designate and characterize the article as the production of that place or establishment rather than of the proprietor. A trade mark of this description is of no value to the original proprietor, because he could not use it without deception, and therefore would not be protected in its exclusive enjoyment. Such a trade mark would seem to be an incident to the business of the place or establishment to which it owes its origin, and without which it can have no independent existence. It should be deemed to pass with a transfer of the business, because such an implication is consistent with the character of the transaction and the presumable intention of the parties.

Decree ordered for the complainant.

Non-Freezing Wet Meters.

Chloride of magnesium is a by-product of salt working, found in the deposits lying above the true rock salt. Three parts of this material are dissolved in five parts of warm water, and diluted to 22–23° Baume, to make the solution for filling meters. The salt costs, in Dessau, 10 marks per 100 kilos. In 1879 a number of new and old meters at a small station were charged with this mixture; and the result has been so favorable, that its use has since been extended. The solution is used in the first filling of consumers' meters, precisely the same as water, and the corrections for level are made with water in the ordinary way at the following visits of the inspectors. After two or three adjustments, however, the water line is found to maintain remarkable constancy, as the solution does not evaporate. In consequence of this feature, there are fewer deposits of water in consumers' pipes.

The greatest advantage on the side of the chloride of magnesium, however, is its power of resisting frost. In Central Europe this is a most important consideration; and when, as in this case, a non-freezing solution is also non-corrosive and non-volatile in hot weather, the argument on behalf of adopting it is conclusive. It might have been thought that the use of this solution instead of water would be an additional expense. But, as already stated, the contrary is the fact; for taking into account the prevention of damage to the meters from frost, the diminished charge for inspection and watering (due to the constancy of the water line), and the saving in special cold weather inspection, there is a considerable economy from the use of chloride of magnesium, apart from the great advantage of preventing complaints from consumers during severe frosts.

Correspondence.

Chewing the Cud.

To the Editor of the Scientific American:

Your article in No. 25, June 21, "Chewing the Cud," is correct, excepting the first paragraph, which with your permission I will proceed to give a reason for, by making a statement of facts which I trust some of your many readers like myself are cognizant of. It is well known that cows lick themselves, and when in company with other cows will lick them also. I am inclined to think that the licking of themselves and each other may be for the purpose of getting a taste of the saline matter exuded from the surface; at any rate the licking is done, and where cattle frequent for a resting place and to ruminate, there are found balls, principally of hair mixed occasionally with a little food. This ejecta gives rise to the "anxiety and turmoil produced on a farm," etc.

It is a question of grave importance for the combined wisdom of the place to tell which of the cows or steers it is that has lost its cud, if there is more than one; anyway, the custom is to make a cud and proceed to cram it down the throat of the unfortunate animal selected.

Now, this ejection of the cud is as much of a natural consequence as any other of the functions performed by the bovine species; at any rate, ejecta, called cuds, are found occasionally, and so long as this is the case, the same inquiry will continue to be made in the future as it has been in the past. WM. LYNE.

Fort Wayne, Indiana, June 23, 1884.

Early Oyster Laws.

To the Editor of the Scientific American:

Having occasion to examine the original colonial laws of several of the New England States, I came across the following, which I believe to be the very first enactment ever made for the protection and preservation of oyster beds. The next in order of time was probably the legislation adopted in 1784 in the State of Connecticut, to the effect that each town might exercise its authority to preserve shell fish within its limits. It is quite probable that there was other early legislation that escaped my notice; and if so, it would be gratifying to have it brought to light.

H. C. HOVEY.

OYSTER LAW, PASSED BY THE GENERAL ASSEMBLY OF RHODE ISLAND AND PROVIDENCE PLANTATION, THIRD TUESDAY OF FEBRUARY, 1734.

"*Whereas, it hath* been sufficiently set forth to this Assembly that sundry evil-minded persons in several towns in this government have, for sundry years past and still do practice the catching of great quantities of oysters to burn into lime, whereby the same are greatly destroyed and diminished, to the great disadvantage of sundry of his Majesty's good subjects in this Colony, who are many times greatly benefitted therby.

"For remedy whereof, Be it enacted by the General Assembly of this Colony, and by the authority of the same it is enacted, that it shall be in the power of the Town Council of each respective Town in this Colony to make such laws, acts and orders as to them shall seem needful and necessary for the preservation of the oysters in their respective Towns in this Government, and for the preventing of the aforesaid evil practice of burning said shellfish into Lime, or otherwise to destroy the same."

Natural Gas.

The committee appointed by the Western Pennsylvania Engineers' Society to investigate the properties of natural gas submitted a report which was read at a meeting of the society on May 20, of which the following is a synopsis:

It set forth that a large number of prominent manufacturing establishments where natural gas is being used had been visited. It is now nearly a quarter of a century since the first wells drilled into the grand old rocks of Venango County gave origin to the great and steadily increasing petroleum industry, but it is only recently it has been realized that with the petroleum is associated an invisible fuel which may yet assume a degree of commercial importance comparable to that of petroleum. Natural gas in Western Pennsylvania is essentially composed of the hydrocarbons of the series known in chemistry as paraffins. Wells drilled for natural gas outside of the oil regions are of recent date, with a few exceptions. The wells at New Cumberland, W. Va., have supplied gas for more than twenty years for the manufacture of bricks. The East Liverpool wells have been burning twenty-five years, and are still productive.

Pittsburg has the advantage of being able to tap three or four very prolific gas belts or fields, viz., the Butler County field, which supplies Spang, Chalfant & Co.; the Bull Creek, which supplies the Pittsburg Plate Glass Company; the Murraysville or Turtle Creek and Lyons Run field, which supplies the gas for the Acme Gas Company; the belt or field in Washington County in which the celebrated McSwigan well is. No doubt other prolific fields will be found in the near future. It is a common opinion among those versed in the management of gas wells that the outflow is subject to a gradual diminution, tending ultimately to total extinction. In many cases the diminution is owing to a choking up of the pipe by deposits.

The number of companies chartered to supply natural gas in Pennsylvania up to February 5, 1884, was 150, representing a capital stock of $2,160,580. Natural gas, next to hydrogen, is the most powerful of the gaseous fuels, and can be used for almost all the purposes to which coal is applied, except for smelting ores in blast furnaces. Being free from deleterious substances, it makes better iron, steel, and glass than coal fuel. For domestic purposes it is also well suited.

The wasteful use of natural gas is deplored by the committee, and they predict that as soon as its superior heating qualities and low price, as compared with coal, are discovered by consumers, more efforts will be made to prevent a reckless waste. The composition of the gas now being brought to Pittsburg renders it improbable that it will compete with coal gas as an illuminant until some specially suitable form of burner has been contrived. Pure marsh gas yields about one-half the light produced by coal gas.

It has been attempted to apply natural gas to the conversion of iron into steel, but thus far the results have been unsatisfactory.

The report goes on to say that the importance of having the high pressure mains as they enter the city suburbs subjected to careful tests, and the mode of laying such pipes under municipal control, cannot be overestimated. The fact that natural gas if mixed with the air will explode on contact with fire is no argument against its general use under due precautions. The odor of natural gas in the mains seems to depend upon the traces of condensible hydrocarbons, for if kept in a closed vessel for a few days the gas becomes absolutely odorless. The odor will therefore in all probability diminish more and more as it is carried away from the wells. It has been found that air containing 10 per cent of Murraysville gas fresh from the high pressure mains has a decided odor. The velocity of the gas depends largely on the amount of friction it has to overcome, as well as the initial pressure in coming from the well.

Natural gas pipes should be laid without any right-angled elbows or other fittings of the kind. A change of direction in the line should be made by bending the pipes, and no bend should have a radius of less than 48 inches for a 6 inch pipe, or eight times the diameter of the pipe. Gas from a well having a pressure of twenty ounces has a velocity of 23,400 feet per minute. A uhlan ball was driven through three miles of a 5⅝ casing pipe in 2½ minutes. When gas is flowing freely from the mouth of a well, the pressure has not been found in many cases to exceed two pounds per square inch. The gas as it issues from the wells has a temperature of from 42° to 45° Fah.

In conclusion, the committee made some suggestions to consumers of natural gas. They recommended that the distributing mains for domestic consumption be of ample size, with a pressure not exceeding 5½ inches water pressure; that an automatic cut-off valve be placed on the service pipe; that carefully selected wrought iron should be used in the construction of pipes; that special care should be taken to see that the valve is so boxed as to permit free outlet to the air of any escaping gas from a leaky main. The use of proper appliances for the admittance of air to the gas jets is also recommended. The committee advocate the placing of burners where natural gas is used so far above the floor as to be beyond the reach of children. The report concludes by urging the necessity of having all gas pipes thoroughly tested.

Electric Lighting by Primary Batteries.

At a recent meeting of the Society of Arts, Mr. Isaac Probert delivered a lecture upon primary batteries for electric lighting, in which he gave the history of such means of lighting from 1802, when Sir Humphry Davy first showed the carbon arc. The main object of the lecturer, however, was to show the comparative cost of electric lighting by batteries and by a dynamo. Taking the case of a house requiring 100 ordinary incandescent lamps, it was shown that the expenditure of energy in the working of the lamps would be 10·05 horse power. Allowing for the loss of energy in the dynamo, at least 12·55 actual horse power would be required from a steam-engine; the weight of coal for which would be about 56 lb., costing (say) 6d. Taking a yearly lighting of 1,800 hours, the annual cost of coal on this estimate would be £45; and the cost of lighting would be £147 a year, or £1 9s. 5d. per lamp. With galvanic batteries, using zinc and strong nitric acid at the rate of 1·03 lb. of zinc per hour horse power of energy, the consumption of metal for 12·55 horse power hours would be nearly 13 lb., costing for zinc alone 2s. 8¼d. per hour. Besides this, the cost of the sulphuric acid to oxidize the zinc, at the rate of 1½ lb. of acid per pound of zinc, would run up the expense to 3s. 11d. per hour. Add to this the value of the deoxidized nitric acid, or 4s. 4d., and the cost of materials alone in the galvanic battery is made up to 8s. 3d. per hour, or £742 10s. per annum. Taking capital into consideration, Mr. Probert brings the cost of every incandescent lamp maintained by battery power to £7 11s. 8d. per annum, as against £1 9s. 5d. with the dynamo. As to the supposed value of the residual products of primary batteries, of which so much is said by various inventors, Mr. Probert thinks the less said the better. In the Telegraph Department of the Post Office no residues are deemed worth preserving except the "black mud" from the Daniell cells, which last year, for the 69,323 cells accounted for brought in only £167 14s., or rather more than ½d. per cell per annum.

The Underground Works at Girard College, Philadelphia.

Underlying the forty-one acres within the inclosure of Girard College walls, Philadelphia, there are 3,500 feet of tunnel, intersecting almost every part of the grounds. The main tunnel is 2,600 feet in length, while the branches run out to the length of 900 feet. The boiler and engine house on the north side of the grounds, opposite Twenty-second Street, are the central point from which the tunnel ramifies. The underground ducts vary in dimensions. A portion of the main tunnel is 8 feet high by 10 feet wide, while in other places it ranges down to 7 by 7. The branches are somewhat smaller, being 5 feet high by 8 feet wide. They are built of stone, with brick arches, at a depth of 14 feet from the surface, and are provided with concrete flooring. At distances of 100 feet apart there are gas jets, which are lighted by electricity. The tunnels are used for the pipes which carry the steam and hot water to the eleven buildings on the grounds. In the various structures there are tanks with a total storage capacity of 34,329 gallons, from which the supply of cold water is obtained. The miles of pipe running through the tunnels contain over 3,000 valves. —*N. Y. Evening Post.*

The Composition of Glass.

Bohemian glass is made with carbonate of potash, as pure and as rich as possible. Hydrate of potash of 54 to 56 degrees is the best for use. Potash used for glass making is extracted from the residuum of beet root sugar making. In Bohemia a potash extracted from wood ashes comes from Hungary. America also furnishes a good article. All potash used in glass making should especially be free from soda, as it tends to give glass a green color.

Soda has taken the place of potash to a great extent. It is used as a carbonate or sulphate. Carbonate is yet used in the manufacture of table ware, but in the making of plate and window glass, bottles, etc., the sulphate is almost entirely used, owing to its cheapness. By adding a small quantity of charcoal to sulphate of soda it is decomposed much more easily.

In the manufacture of flint glass lead is used in red oxide form, or sometimes a litharge, but the red oxide gives the best results. Red lead furnishes oxygen, which escapes in melting, and serves to refine the glass and burn the organic matters which may be contained in the mixture of materials. Red lead is prepared from the purest of leads coming from England and Spain, which are comparatively free from the oxides of iron, copper, etc. Lead is used in this country for glass making, by those manufacturers who make a superior quality of glass.

In the manufacture of plate, window, or white glass, lime is used as a carbonate or slaked.

It is important that sands should be selected with care, as impure silica has the most detrimental effect upon the color of glass. This is especially important in the manufacture of fine table ware, plate, and window glass. All sands should be free from iron, as this is the fruitful source of the green coloration of all glasses. In Bohemia quartz is used instead of sand. It is first heated, then thrown in water; this breaks into many pieces, which are subsequently reduced to fine powder by mechanical action in wooden mortars with quartz pestles. By this means the introduction of iron is avoided.

France and Belgium, for the manufacture of fine wares, use the Fontainebleau sand, not far from Paris; also the sands of Nemours, Chantilly, and from the province of Champagne. These sands are used for flint, plate, and first quality window glass.

English sands contain a considerable proportion of iron. Silex is sometimes used instead of sand for fine wares. For plate glass making sand from the Isle of Wight is used, but for the best qualities of glass the English manufacturer has to import sand from France and this country. Bottle manufacturers, on the contrary, seek sands containing iron and clay, on account of the elements they contain acting as a flux.

Silica is found in the shape of quartz, rock crystal, sand stone, and quartz sand in the crystalline form; in silex or flint stone in the amorphous state. Silica is one of the most abundant natural substances; it is insoluble in water; and resists the action of most chemicals. Among the acids only one, hydrofluoric acid, is capable of decomposing it; this acid decomposes and dissolves glass entirely. Silica, although infusible at the highest temperature of furnaces, has nevertheless been fused by the use of the oxyhydrogen blow pipe. Silica combines with all bases, alkalies, such as potash, soda, and with metals, lead, and bismuth. These give it the property to form vitreous compounds. Lime, magnesia, alumina, form with it infusible compounds; the latter, however, mixed with silicates of potash, soda, or lead, furnishes compounds which are suitable for the work of the glass blower. It is glass proper. If two infusible silicates are mixed together, they nevertheless produce fusible glass. Fine plate glass has been made with a compound of sand, slaked lime, and carbonate of baryta. This glass, as fine as ever made, contains, on being analyzed: Silica 46·5, baryta 39·2, lime 14·3, total 100.

To produce a glass requiring as little fuel as possible, the glass maker should introduce as many bases as possible in his mixture, such as potash, soda, lime, magnesia, alumina, oxide of iron; these, however, more particularly in bottle glass, where color is not so much an object as cheapness. *Per contra*, in making pots the clay should be as free as possible from a mixture of bases; simple silicates, such as silica and alumina, are preferable.—*Glassware Reporter.*

An Autographic Record of the Vibrations of a Tuning Fork.

The exact determination of the rate of vibration of a tuning fork by means of the siren has heretofore been attended with errors, resulting from imperfections of the recording gear and difficulty of maintaining and counting the beats of the two tones. These errors have been sought to be removed by obtaining autographic records of the rate of the siren and of the difference between this rate and that of the fork. The experimenter, while obtaining these results, being freed from the necessity of even counting the beats, no personal element enters into the observation, and the records, being permanent, can be studied at leisure. The apparatus with which these results are obtained is described in the *Amer. Jour. of Science*, the method employed being the following:

A strip of chemically prepared paper, which rests on a metal wheel, being drawn by clockwork under three platinum pens placed in electric circuits, three simultaneous electro-chemical records are obtained. One of these is a line of dots made at the rate of one a second, by a chronometer placed in the circuit of the same battery with one of the pens. The second is a row of dots made by a closing of the same circuit by a siren once in each revolution, while singing nearly in unison with the fork. The third is a row of dots made by the closing of the circuit of a second battery, once for each beat of the fork and siren.

It thus results that from the same strip of paper can be counted the number of revolutions made by the siren in any number of seconds (which gives the number of impulses produced by the siren) and the number of beats in the same time, which is the difference between the number of shocks imparted to the air by the siren and the number imparted by the fork. The record being made without throwing any work upon the fork, the rate of vibration of the unconstrained fork results.

Roman Remains in London.

The extension of the Metropolitan Railway in London, requiring deep excavation in the very heart of the city, has given occasion for many interesting discoverics. A part of the new line, from the Mansion House Station to the Minories, on the north side of the Thames, and near the shore, is cut through soil which has been accumulating during much more than two thousand years of continuous occupation, and relics, not only of Roman but of British London, have been exhumed in abundance. Just south of the Bank of England the excavation crosses a handsome street known as Walbrook, on each side of which is a little eminence, that to the east have been reputed to being the site of the fortress of the British Prince Cassivelaunus, who fought against Julius Cæsar; while that on the west formed part of the Roman colony subsequently established. In digging under Walbrook, the bed of the ancient brook from which it takes its name was laid bare, and two small landing stages, for boats from the neighboring river, were exposed.

Both of them were built upon oak piles, and one had a quantity of oak tree roots thrown in among the piles, showing that the oak trees used were cut upon the spot, and the roots and useless twigs thrown in among the piles as the readiest way of clearing the ground Over the piles, in each case, was a bed of concrete, and on this was a pavement of red Roman tiles. It is quite possible that the Roman pavement may have taken the place of a wooden platform, belonging to the original structure, which had fallen into decay, so that two thousand years may have passed since the piers were built. About them were found one or two skulls, of a British type, besides Roman pottery, leaden coffins of a Roman design, and a perfect bronze statue of heroic size. Not far off, at the bottom of a shallow well, was found, with its head downward, the skeleton of some unfortunate Briton, who had either been thrown or had fallen in, and had been left there, disregarded alike by his friends and by those who drank the water of the well.—*Building News.*

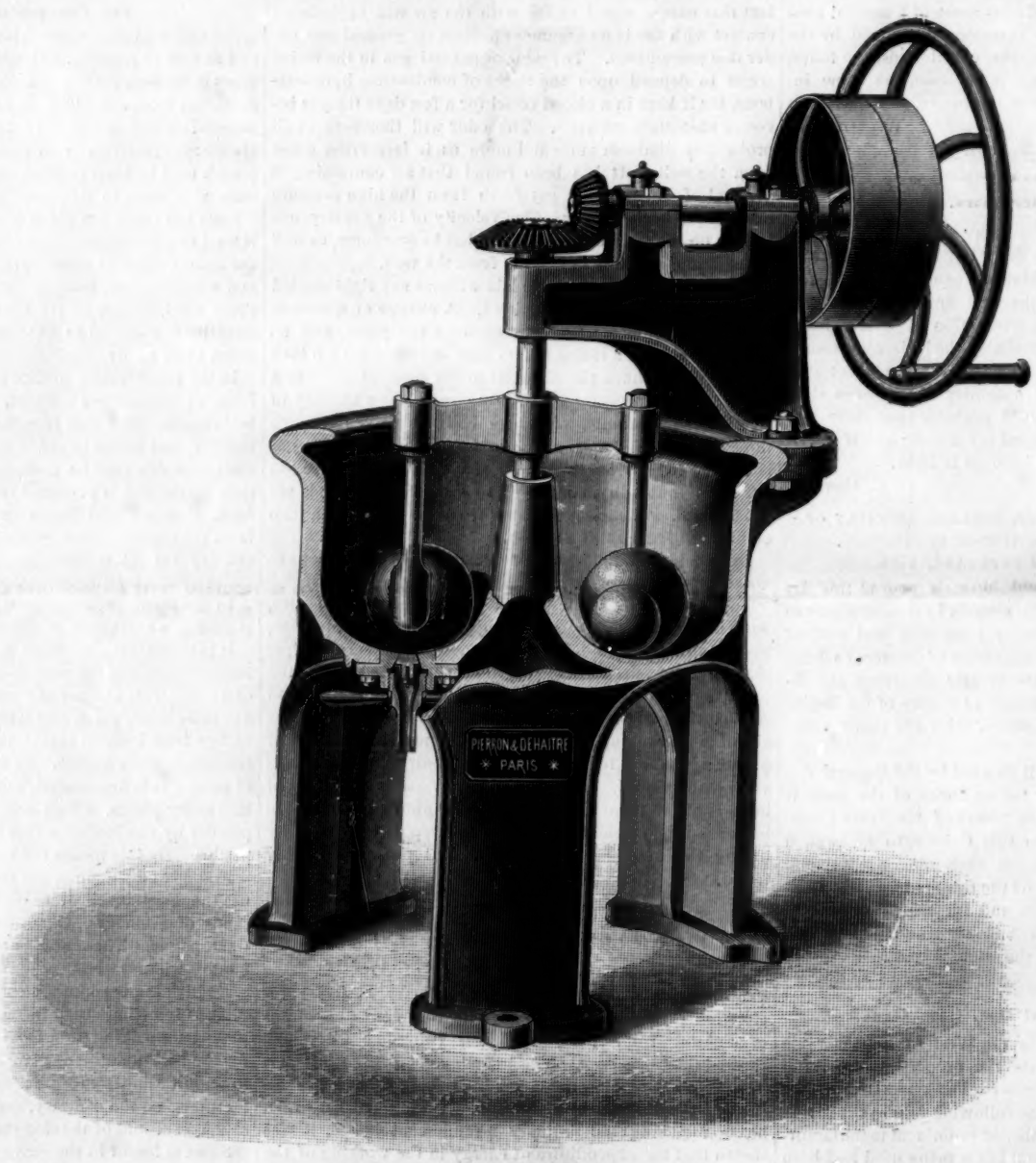
MACHINE FOR GRINDING INDIGO AND ULTRAMARINE.

Indigo and ultramarine are, like all colors in general, very delicate materials, that require a lengthy grinding in order to render them perfectly homogeneous. Messrs. Pierron and Dehaitre's machine, which is represented herewith, is designed for performing this operation mechanically. It consists of a circular vessel resting upon three supports cast in a piece with it, and containing in its center a projection which serves as a bush for a vertical shaft that carries a bevel pinion at its upper part.

Upon this shaft there is fixed an iron crosspiece carrying a paddle at each extremity. These two paddles, on being set in motion by manual power or otherwise, revolve continuously around the shaft that carries the crosspiece, and push ahead, each of them, two spheres turned out of cast iron and of different diameters. These spheres, on rolling over the indigo or ultramarine slightly moistened with water, reduce all the granular portions to a very fine paste, and convert them into a very homogeneous material which is then in a state to be delivered to the industries.

The spheres have different diameters and weights, so that, under the action of centrifugal force, the smaller ones shall not have the same rolling circumference as the larger ones, and that the process of grinding shall thus be accelerated. For extracting the ground material from the apparatus when the operation is finished use is made of a cap in the form of a valve. It is only necessary to unscrew by a few turns the threaded rod which carries the conical cap to cause the latter to leave its seat and give sufficient passage for the flow of the ground material.

This machine revolves at the rate of 50 or 60 revolutions per minute. It is capable of grinding 15 kilogrammes of indigo in 10 hours, and costs 580 francs.—*Annales Industrielles.*



MACHINE FOR GRINDING INDIGO.

The Road to Riches.

One of the richest men in Chicago was asked for a private interview by a *Wall Street News* reporter, who explained: "You are very rich. You have had wonderful luck. Tell me what to speculate in, that I may make money."

"Never speculate at all," was the serious answer.

"But you have made money in railroad stocks, wheat, silver mines, canal stocks, etc."

"Not a dollar, young man! In fact, that's the way I have lost thousands."

"Why, then, how have you made your wealth?"

"By inventing a spring bed, and patenting a bootjack. Let all speculation alone, and turn your attention to the solid wants of the people."

Cedar Shingles.

White cedar shingles are the curiosity of the northwestern lumber trade. They are such for the reason that they are much better than white pine, and yet the majority of consumers do not know it. Men are continually buying pine roof covering, when they could purchase just as handily a better article for less money than pine costs. A special curiosity in connection with cedar shingles is this, that, while a large proportion of the settlers throughout the Northwest originally came from New York, New England, and Canada, and cut their teeth and gloried in their first pair of boots under a white cedar shingle roof, they seem to have forgotten all about this material since they became citizens of the Northwestern States.

The wholesale lumber dealers give as a reason why cedar shingles are not carried in stock more extensively that there is little demand for them. Nearly everybody wants pine. The wholesale dealers, like other merchants, handle the kind of goods there is the more sale for. But a progressive trader will endeavor to educate his customers. This the pine merchants have not attempted to do to any great extent as yet.

The lasting quality of good cedar shingles should insure their dominance over pine, leaving out any other consideration. It is positively asserted by good authority, that cedar shingles are less liable to warp than pine, stay where they are put better, draw nails less, and consequently make a tighter roof than pine. In places where pine and cedar shingles have been used on contiguous roofs, it has been observed that the pine roofs look old and dilapidated while yet the cedar shingled roofs look as well as when first put on. All who are in any way acquainted with the quality of cedar know that it has great endurance against the effects of moisture and alternate moisture and dryness. Cedar is the favorite wood for posts and pavement on this account. Cedar shingles on roofs have been known to last forty years. There is a shingle in this office to-day that was taken from a roof in the State of Maine, where it had lain forty years. Half of the weather end is worn away, but enough is still there to shed rain. The writer of this was nurtured in his childhood under a cedar roof that tradition said had lasted fifty years; and when it was demolished to make way for a new one, the shingles were still sound, though moss covered and worn. There is no question but that cedar shingles are much more durable than pine.

The quality of lightness in cedar shingles is greatly in their favor as material for shipment. The lumber trade of this city, especially, has a long reach. In reference to shingles, far away Kansas, Nebraska, Dakota, and Texas are the more important distributing fields. The lighter shingles can be made the more profitable is their shipment. They are very dry pine shingles that are made to weigh but 245. Cedar shingles can be made to weigh but 200 and less pounds per thousand. This results in a great difference on a car load.

Up to the present time cedar shingles have sold considerably cheaper in this market than pine. The current prices by the cargo range from $1.50 to $2.00, which includes standard and extra. The range on the same classes of pine shingles is $1.75 to $2.20.

In view of the excellence, the durability, and the cheapness of cedar shingles there can be no reason why they should not sell in larger quantity than pine shingles, unless it is that they are not so extensively manufactured. The only possible objection to cedar shingles is that they cannot usually be made as wide as pine shingles. But that is not a serious objection, since cedar shingles do not shrink, warp, nor split as badly as pine, and cedar lays a roof that stays in place better than pine.—*Northwestern Lumberman.*

LAST year the German Lifeboat Society saved 277 lives, the rescued persons belonging to 47 German vessels, and to 5 English, 4 Dutch, 4 Swedish, 3 Danish, and 2 Russian ships. The society supports 87 lifeboat stations.

NEW AUTOMATIC CUT-OFF AGRICULTURAL ENGINE.

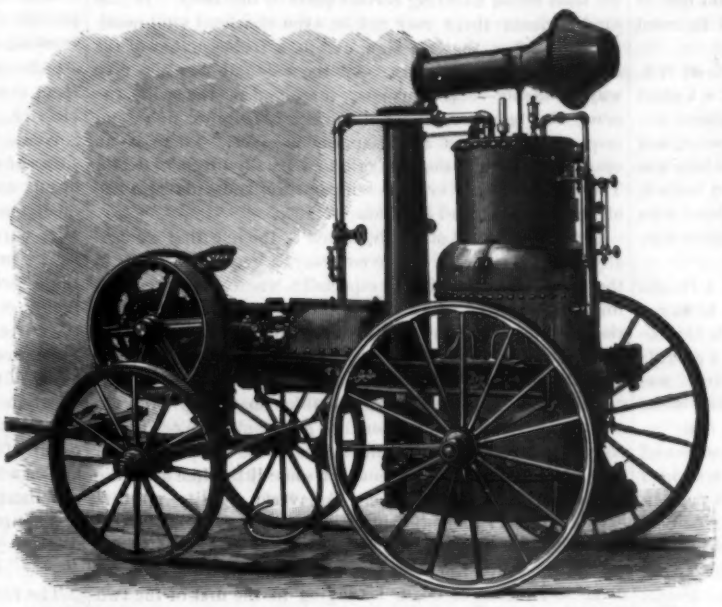
The annexed cut represents a new agricultural engine manufactured by Shapley & Wells, of Binghamton, N. Y.

The points claimed are the application of the well known merits of the automatic cut-off to the purposes for which agricultural engines are commonly used, such as thrashing, pressing hay and straw, sawing wood. The valve is a new method of balancing a slide valve, so simple that there is no liability to get out of order in the hands of the most unskilled engineer. Steadiness of motion, showing not over two per cent variation between light and rated power. Impossibility of running away and wrecking the machinery by the breaking of a governor belt, as there is no belt to break, the governing being done entirely in the balance wheel. Economy in fuel and water, using but from one-half to two-thirds of that used by a throttling governor engine.

The frame supporting the engine and boiler is made of wrought channel bar hung on elliptic springs at the rear axle, causing the engine to run smoothly on the road. Wheels are large, making draught light. Pump and heater, and injector, are attached.

The boiler is the Shapley patent, having a conical fire box with horizontal and vertical tubes, removable jacket allowing the engineer to clean tubes while steam is on. It is furnished with suitable plugs at bottom for cleaning water space when necessary.

It is also claimed that the boiler is practically sparkless, from the circuitous route through which they are obliged to pass, nearly all being deposited in the base, the condensation from the heater being all thrown into stack, thereby quenching any stray spark that might exist when dry wood is being used.



SHAPLEY & WELLS' NEW AUTOMATIC CUT-OFF ENGINE.

Prevention of Noise.

To those who carry on any operations requiring much hammering or pounding, a simple means of deadening the noise of their work is a great relief. Several methods have been suggested, but the best are probably these: 1. Rubber cushions under the legs of the work bench. *Chambers' Journal* describes a factory where the hammering of fifty coppersmiths was scarcely audible in the room below, their benches having under each leg a rubber cushion. 2. Kegs of sand or sawdust applied in the same way. A few inches of sand or sawdust is first poured into each keg; on this is laid a board or block upon which the leg rests, and round the leg and block is poured fine dry sand or sawdust. Not only all noise, but all vibration and shock, is prevented; and an ordinary anvil, so mounted, may be used in a dwelling house without annoying the inhabitants. To amateurs, whose workshops are almost always located in dwelling houses, this device affords a cheap and simple relief from a very great annoyance.

How the Salt Glaze was Discovered.

In 1680, a very simple accident revealed to the English potters a secret which they ought to have learned long before from the Dutch wares imported into that country. A maid-servant at the farm of Mr. Yates, near Burslem, was preparing in an earthern vessel a salt lye for curing pork. During her temporary absence the liquid boiled over, the sides of the pot became quickly red hot, and when they again grew cold, were found to be covered with an excellent vitreous glaze. The circumstance attracted the attention of Mr. Yates, who related it to a neighboring potter who at once made use of the discovery and imparted it to others. This "salt glaze" soon to a great extent superseded the lead ore glaze hitherto in use, and was employed in the manufacture of "crouch ware," in which all ordinary articles of domestic use produced at Burslem were made.

Photography with Colors.

A weak print is made from a negative, and after finishing is well washed. This print is then tinted by flat washes of the colors desired, which are diluted with salted albumen instead of water. The print so treated is next floated on a sixty grain bath, dried, and placed under the negative, care being taken to insure its proper registration. The rest of the operations are as usual. Another method consists in painting a weak proof with water color pigments let down with salted albumen. It is then coagulated with alcohol, recoated with salted albumen, floated on silver, printed, and finished as usual as just described.

ATTITUDES AFTER DEATH.

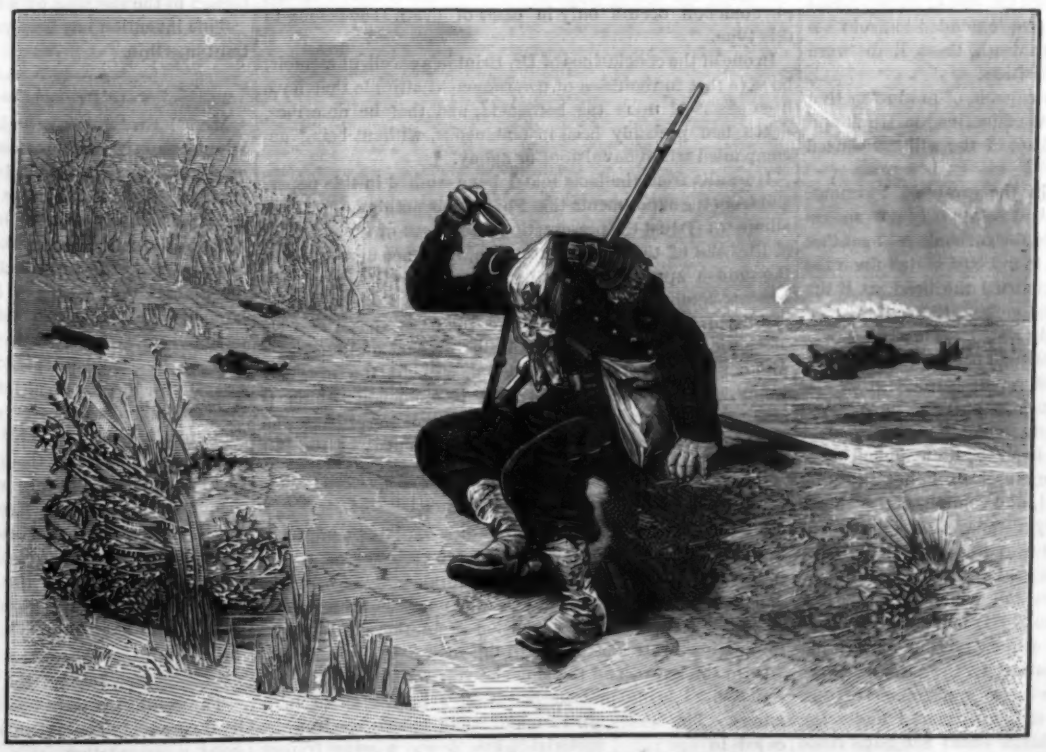
BY C. E. BROWN-SEQUARD.*

Among the phenomena sometimes noticed at the hour of death there is one that offers a peculiar interest, and which, up to recent times, has remained a mystery. This phenomenon appears especially, but not exclusively, after a sudden death due either to wounds received upon the field of battle or elsewhere, or to other causes, but almost always when there has been an intense excitement, and often also when great bodily fatigue has preceded the last moment of life. The principal feature of this curious fact is the persistence after death of the expression of the face or of certain attitudes of the limbs or body, or of both. Such persistence exhibits itself clearly in certain cases; for example, when, despite the sudden cessation of life, a limb that is raised does not drop, or when the body of a man standing, or seated upon horseback, does not fall over.

In order to clearly understand the terms of the problem to be solved in reference to this phenomenon, it is absolutely necessary to know (1) that our attitudes and facial expression depend upon a contraction of our muscles due to an influence of the nervous centers, and (2) that such influence necessarily ceasing at the instant of death, a relaxation must also necessarily occur in all the muscles that were contracted, unless some other agency at once replaces that which has disappeared and causes the same physical state to persist that formerly existed therein.

The question, then, is this: What is the agency that, as soon as the faculty of volition vanishes, takes the place of the latter, or at least produces in the muscles an organic state that prevents all relaxation?

The object of this article is to answer this question, and to show that the cause or agency to be discovered is not the sudden appearance of that state of muscular stiffness known by the name of *rigor mortis* or *cadaveric rigidity*, but that such agency is found in a peculiar action of the nervous centers that manifests itself a little before or at the instant of death. One of the most striking examples of the strange fact that I am about to study was observed by Dr. Rossbach, of Wurzbourg, upon the battlefield of Beaumont, near Sedan, in 1870. He found the corpse of a soldier half sitting, half reclining, upon the ground, and delicately holding a tin cup between his thumb and forefinger and directing it toward a mouth that was wanting. The poor man had, while in this position, been killed by a cannon ball that took off his head and all of his face except the lower jaw. The body and arms at the instant of death had suddenly taken on a rigidity that caused them to afterward remain in the position that they were in when the head was removed. Twenty-four hours had elapsed since the battle, when Dr. Rossbach found the body in this state. (See engraving.)



ATTITUDE OF A SOLDIER ON THE BATTLE-FIELD TWENTY-FOUR HOURS AFTER DEATH.

In the first work of any importance in which this subject has been treated of, Dr. Chenu relates that a French military surgeon, Dr. Perrier, was greatly surprised upon going over the battlefield of Alma, the day succeeding the terrible conflict, to see that many corpses of Russian soldiers had attitudes and expressions of countenance like those of living persons. Some of these corpses had the different expressions that characterize anguish, suffering, or despair. Others, on the contrary, had the appearance of greater calmness and resignation.

One case, particularly, attracted the doctor's attention, where the body lay stretched out upon the ground, the knees bent, the hands clasped and lifted in the air, and the head thrown back, as if death had come upon the individual while he was reciting a prayer. In addition, many other persons who have visited battlefields immediately after a conflict tell us that they observed numbers of corpses that were still holding their guns or sabers. Some seemed to be biting their cartridges, while others, still upon horseback, continued to preserve the attitude they had at the moment of death. These phenomena have been studied with special attention by Dr. Armand at Magenta, by Baron Larrey at Solferino, and by Dr. Baudin at Inkermann.

I owe to the kindness of Dr. S. Weir Mitchell a knowledge of an excellent memoir by Dr. John Brinton, of Philadelphia, upon the "Rigidity which Accompanies Sudden or Violent Death"—a work in which the question under consideration is studied with the greatest care. Speaking of the field of battle of Antietam, Dr. Brinton says that he counted forty corpses over a space of from 40 to 50 yards square, and he gives us the following picture of what he observed in this place:

"Several of these corpses were lying in extraordinary attitudes, some with their arms lifted and rigid, and others with their legs drawn up toward the trunk, and stiff. With others, in quite large number, the trunk was curved forward and also rigid. In a word, these attitudes were not those of the state of relaxation produced by death, but rather those of an apparently active character, doubtless due to a final muscular act at the very moment of the extinction of life—a spasmodic act that had left the muscles stiff and inflexible. Death, in the majority of these cases, had been caused by wounds made in the breast; and, less frequently, by balls that had traversed the head or abdomen. In the latter cases there had been considerable hemorrhage, as was proved by the pools of blood of dark color near the sides of the bodies. This inspection was made thirty-six hours after death, or still later."

The following three cases related by Dr. Brinton (which were furnished to him by friends) are very remarkable·

A detachment of United States soldiers, foraging around Goldsborough, N. C., came suddenly upon a small band of Southern troopers who had dismounted. These latter immediately jumped into their saddles, and all scampered away except one, after being exposed to one round of fire. The soldier who did not escape was sitting upright, one foot in his stirrup. In his left hand he held the bridle and the horse's mane, while his right hand grasped the barrel of his rifle, near the muzzle, the stock of the gun resting on the ground. The horseman's head was turned toward his right shoulder, apparently watching the approach of the assailing party. Some of the soldiers of the latter were preparing to fire again, when their officer ordered them to desist, and to go and make the defiant man a prisoner. The latter, upon being ordered to surrender,

* *La Nature.*

made no answer. When he was approached and examined, it was found that he was dead and rigid in the singular attitude that we have just described. It took considerable of an effort to force his left hand to release the horse's mane and to remove the rifle from his right hand. When the body was laid upon the ground, the limbs preserved the same position and the same inflexibility. This man had been struck by two balls fired from Springfield rifles. One of these had entered to the right of the vertebral column and had made its exit from the body near the region of the heart. It had left its track upon the side of the saddle, and had then dropped to the ground. The other ball had entered through the right temple, and its point of exit could not be found. The horse had remained quiet, as he was fastened by a halter.

The following is another incident: At the battle of Williamsburg, Dr. T. B. Reed examined the body of a United States zouave who had received a ball in the forehead just as he was climbing over a low fence. He, likewise, had preserved the last attitude of his life. One of his legs was half over the fence, while his body still remained behind. One hand, which was partially closed, was raised level with his forehead, with the palm forward as if to preserve himself against some imminent danger.

Dr. Henry Stillé relates that, while seated upon a freight car on the Nashville and Chattanooga Railroad, he saw a brakeman instantly killed by a ball which struck him between the eyes, a mortal wound that was given by a guerilla who lay in ambush in a forest through which the train was passing. The man thus killed was tightening the brake when he received the ball. After his death his body remained fixed, the arms extended and stiff on the handwheel of the brake. The pipe that he was smoking remained fastened between his teeth. The rigidity was so perfect, and his hands were so tightly closed, that it was scarcely possible to free the corpse and make it let go its hold.

A maintenance of the last attitude may occur under circumstances other than a sudden death produced by lesions of the brain, heart, or lungs, although an injury to an organ of great importance to life is the most frequent cause of the phenomena. Dr. Brinton has observed it after wounds made in the abdomen, and Dr. Armand, in a single case, through a wound of the thigh.

Yet this phenomenon does not manifest itself exclusively in cases where death results from wounds. It was observed in a horrible accident that happened at London in 1867, when forty-one persons, skating upon Regent's Park Reservoir, perished through the sudden giving way of the ice. The following extract from the *Times* concerning this event is full of interest:

"The attitude of the majority of the persons who were taken from the water has given rise to numerous discussions in the medical journals. In almost all cases the arms were raised, and sometimes the elbows were pressed against the sides. In other cases the elbows formed a right angle, and projected as in the act of skating. It may be concluded that these unfortunates were resting upon the ice with their arms, not daring to use their hands, and that when, on becoming exhausted, they died, it was not through asphyxia, but rather through the action of cold and fright; and this would explain why they preserved the position in which they were found."

Dr. Taylor had already mentioned the case of an individual who had for a long time held his arms extended to avoid being drowned, and in whom, after death, these limbs were found stiffened out in the same position.

It seems that carbonic acid is capable of producing that special rigidity of the muscles that maintains the trunk and limbs in the attitude that the last act of the will has caused them to assume.

In 1832 Dr. Von Graefe saw, in the grotto of Pyrmont, the corpse of a young man who had voluntarily put an end to his days by exposing himself to the carbonic acid gas that fills this cavern. The body was found half seated upon the ground. One of the hands supported the head, as if the young man had desired to avoid touching the wall, against which the upper part of his body rested. The trunk was bent toward the right. The attitude of the body had the appearance of a person asleep and reposing peacefully.

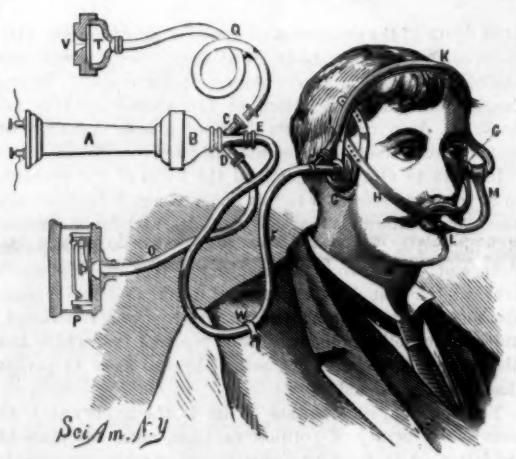
How shall we explain this curious series of facts? We know that sooner or later there supervenes a stiffness (called *cadaveric* or *post mortem rigidity*) in all the limbs and all other parts of the body where there are muscles. Is not the stiffness that occurs on the battlefield, and sometimes elsewhere, immediately after death, merely a cadaveric rigidity that has come on suddenly? Those who know the law that I have established concerning the rapidity or retardation of cadaveric rigidity after death (see my Croonian Lesson before the Royal Society of London, 1861) will find it evident that in the majority of the cases of preservation of attitude after death that I have just mentioned, the circumstances were very favorable for the prompt appearance of *post mortem* rigidity. Yet, even in the cases placed under the most favorable circumstances, death could not have come on quickly enough to permit of the preservation of an *ante mortem* attitude. This is a sufficient reason to assure us that the fact that we have to explain is not due to the sudden intervention of cadaveric rigidity. But how, then, shall we explain this fact?

Some experiments that I cannot here give the details of have shown me that it is a fixed contraction—a tonic, persistent, muscular action which then occurs, similar to that which it replaces, and which existed during life. At the very moment that death comes on, this fixed or tonic contraction occurs. It is an act of life, but the last one. I have sometimes seen this contraction exhibit itself and then disappear, and it was not till later that the true cadaveric rigidity supervened.

Death, in man as in animals, takes place in two ways that differ radically from each other. On the one hand, it may supervene suddenly, either through the influence of excitement or that of a wound or blow, or, again, through the following causes: The impression produced by submersion in cold water, or in almost icy water, and the impression produced sometimes, in persons who are eminently nervous, by the least lesion affecting certain parts of the body. In this kind of death there may not be even the least vital manifestation after the last sigh, except a feeble action of the heart that soon disappears. All the cerebral faculties give way suddenly—consciousness, intelligence, the will, the perceptive faculties, sensorial and sensitive impressions, and respiratory motions all disappear at once. There is no *agony*, and none of that struggle that usually precedes death. The body suddenly loses its temperature, and cadaveric rigidity comes late, and lasts considerably.

In the other kind of death, which is the one that we usually observe, there is, on the contrary, a genuine struggle in the still living organism, especially when life is ending through the effect of certain wounds or of a great hemorrhage, or as a consequence of a complete and sudden deprivation of respiration. The heart in such a case beats violently, the efforts made to breathe are extremely energetic, consciousness and the cerebral faculties may keep up for a short space of time, and after this, great agitation or general convulsions occur. The temperature of the body rises, and this increase may still continue for some little time after the last effort made to breathe. Cadaveric rigidity appears early, but never immediately.

My experiments and the details of the cases that I have related show that the persistence of the last attitude does not occur in all cases of death belonging to the first of the two types just described; but facts indicate that this singular phenomenon occurs only in cases of death that belong to this type.



WARTH'S TELEPHONE SUPPORT.

In one of the conclusions of Dr. Brinton's excellent memoir, he says that in the cases of persistence of attitude that have been observed upon the battlefield, and that he describes, death had probably been instantaneous, without being accompanied with convulsions or agony.

It results from the facts that I have studied in this paper, and from the experiments that I have done nothing more than allude to: (1) that the preservation after death of the attitudes of life, and of the facial expression, does not depend upon the sudden appearance of what is called cadaveric or *post mortem* rigidity, but upon the production of a vital act of rigidity or tonic contraction, like the fixed spasm that we often see in hysterical or paralytic persons; and (2) that a number of causes of death, acting without the ordinary agony, may produce that strange phenomenon which is characterized by a persistence after death of the attitude and facial expression that existed at the moment of the last sigh.

A Strong Money Box.

Mr. William H. Vanderbilt's treasure vault, in which it is said he recently stowed away some $100,000,000 in securities, is one of the most redoubtable works of defense on the American continent, though you may not be entirely certain of that by surveying his mansion from the outside. Its foundations were blasted out of the rock; the front wall is 5 ft. in thickness, and the side and rear walls 3 ft., the materials used being pressed brick with brown stone trimmings. The beams, girders, and main pillars are iron, incased in fire proof material. The doors, window frames, and minor partitions are iron, marble, and glass. No wood is to be found in the structure. The great vault is 36x42 ft., of wrought iron, steel, and Franklinite iron, is imposing in strength and proportions, and is situated on the ground floor. Its four outer doors weigh 8,200 pounds each, and have every effective and known improvement in defensive devices. A massive wall of masonry surrounds the iron work. The vault, which is burglar, fire, and water proof, constitutes a distinct building in itself.

Anti-Induction Wires.

Mr. F. N. Gisborne, superintendent of the government telegraph service of Canada, has introduced his new system to obviate the evil effects of electrical induction in underground and aerial conductors.

Experiments have been made with a section of cable about three thousand feet in length, constructed under his direction, and laid underground between two of the departmental buildings in Ottawa. The cable contains twenty indifferently insulated conductors or wires, which are divided into pairs, two conductors being twisted together in each case. Each pair constitutes a metallic circuit, one conductor being used as a "return," instead of the earth plates usually employed. The peculiarity of the invention consists in the twisting of these metallic circuit conductors, as both wires are thus made to occupy an equidistant relationship with respect to any other conductor or pair of conductors in their vicinity. By this device a current introduced into a circuit is conducted down one wire, and up the other; and, the position of both wires being the same with respect to neighboring circuits, the inductive effect of the current passing down one wire is neutralized by the inductive effect of the same current passing up the return wire.

The twisting of the wires of the metallic circuits lessens the effect of induction of the current upon itself. When the wires of a metallic circuit are laid parallel throughout, the current induced from one wire into the other is in the same direction as the current itself passing in that wire; the effect of the current is therefore prolonged, and retardation experienced in a marked degree; whereas, when the wires are twisted closely (say, two turns to the inch), the wires occupy throughout their length a position approaching right-angles with respect to each other; and the induced currents are thereby materially lessened, and retardation rendered less appreciable.

TELEPHONE SUPPORT.

The receiving telephone, A, is of the ordinary construction, and is supported in a fixed position; it is provided with a mouthpiece extension, B, having three branch tubes, D C E, for receiving flexible tubes. A curved spring, I, of nearly semicircular form, is jointed to a similar spring, H, and these two springs are kept in a fixed position in relation to each other by the brace, N, which is made adjustable in order to adapt the apparatus to the heads of different users. Attached to the ends of the spring, I, are earpieces, G, provided with tubes, F, having branches, J. The tube, F, communicates with the central tube of the extension, B, on the receiving telephone, and the tube, K, communicates with the other earpiece, and a branch, M, communicates with the mouthpiece, L, secured to the center of the spring, H. By this means the earpieces and the mouthpiece are held in position for use. The branch, D, is connected with the transmitter, P; the branch, C, is connected with the earpiece, T, to enable a second person to listen.

Sounds produced by the receiver diaphragm are communicated to the ears through the tubes, F K, and the earpieces; and speech uttered in the mouthpiece affects not only the transmitter through the tubes, M, K, F, and O, but also the receiver, which thus acts as a transmitter also and augments the volume of sound transmitted. To prevent the accidental jerking of the apparatus from the head, the tube, F, is attached to the clothing by a clasp pin.

This invention has been patented by Mr. N. G. Warth, of Canton, Ohio.

New Process for Preserving Meat.

Mr. Richard Jones, who has for many years devoted his attention to the preservation of meat, has now adopted a new process. The principle consists in the injection of a fluid preparation of boracic acid into the blood of the animal immediately after it has been stunned, and before its heart has ceased to beat; the whole operation, including the removal of the blood and chemical fluid from the body of the animal, only taking a few minutes. The quantity of boracic acid used is very small, and that little is almost immediately drawn out again with the blood. The preservation of the flesh is said to be thoroughly effected; the quantity of the chemical left in the flesh must therefore be very small, and can scarcely be injurious to the human system; for, as Professor Barff has proved by experiment, living animals, either of the human or other species, do not seem to be injured in any way by the consumption of it. A demonstration of the effects of the process was given in April at the Adelphi Hotel, London, when the joints cut from a sheep that had been hanging for more than seven weeks at the house of the Society of Arts were cooked in various ways, and those present agreed that the meat was equal to ordinary butcher's meat.

The Louisville Exposition of 1884.

The exhibition of last year at Louisville, Ky., was a brilliant success. The attendance was large, and there was a good representation from all parts of the country. The managers state that of 600 car loads of machinery sent there from the Eastern States, less than 100 car loads were returned, so large a proportion of the articles having been sold during the exhibition. The exhibition this year will open August 16, and close October 25. Louisville is now very near the center of population of the United States, and there is no better section of the country for the enterprising manufacturer seeking a market than is to be found within a radius of two or three hundred miles of that city.

Paper Making Materials.

The attention that has been given of late years to the very important question of the paper supply has resulted in the more general utilization of many products that were but a few years ago scarcely known. The threatened exhaustion of the esparto supply went a considerable way to turn the attention of paper makers to other sources of material, and fresh substances are now frequently brought to notice, the young shoots of the bamboo being among the most recent. The essential for a good paper is a substance that will pulp well, and at the same time possess a fiber sufficiently tenacious to strengthen the paper when finished; thus the well known India papers made from the tough, fibrous barks of Daphne papyracea and D. cannabina are celebrated for their great strength; and again the Japanese papers made from the inner barks of Broussonetia papyrifera and B. Kæmpferi are sometimes made as thin as gauze, and yet on account of the interlacing fibers they possess considerable strength.

Everybody knows how multitudinous and varied are the uses to which the Japanese apply paper. It is then to some of these well known foreign sources of paper material, the suitability of which is abundantly proved, that we ought to look for some of our future supplies. It is not impossible perhaps to export the material in the form of paper stock or half-stuff, and we might perchance get this either from the Indian daphne or the Fijian or Japanese broussonetias; besides which, the plants themselves might be introduced into some of our colonial possessions, and grown for the sake of their fibrous bark; indeed, this would seem to have been already begun by Dr. King in the Botanic Garden, Calcutta; for in his last report on these gardens he says: "The paper mulberry (Broussonetia papyrifera) grows wonderfully well, and I am trying to obtain the seed in large quantity from Europe, so as to be able to spread its cultivation in India." This, then, would seem to be a new branch of culture well worth consideration and experiment by planters in various parts of the world, for the trees might even be planted on the boundaries of plantations or as shade trees.

The paper mulberry grows everywhere in Japan, and is a valuable tree, as furnishing the bast from which a large portion of the Japanese paper is made. The plants are reproduced in quantity by subdividing the roots, and in two or three years are ready to be cut. This work is done in November, and the branches, 7 to 10 feet long, are made up into bundles 3 or 4 feet in length, and steamed, so that the bark is loosened, and can be more readily stripped off. This is washed, dried, and then again soaked in water and scraped with a knife to remove the outer skin, which is used for inferior kinds of paper. The bast, when cleaned, is washed, repeatedly kneaded in clean water, and mixed. It is then bleached in the sun until sufficiently white, after which it is boiled in lye, chiefly of buckwheat ashes, to remove all gummy matters. The fibers are now readily separated, and are transformed into pulp by beating with wooden mallets. The pulp is mixed in vats, with the necessary quantity of water, to which is added a milky substance prepared from rice flour, and a gummy infusion of the bark of Hydrangea paniculata, or of the root of Hibiscus manihot.

The "couches" on which the paper sheets are produced are made of bamboo, split into very fine sticks, and united in parallel lines by silk or hemp threads, so as to form a kind of mat. This is laid upon a wooden frame, and the apparatus dipped into the vat, raised and shaken, so as to spread the pulp evenly, after which the cover is first removed, then the bamboo couch with the sheet of paper, and in returning the operative lays the sheet upon the others. When a number of sheets have thus been prepared they are pressed, to exclude the water, and afterward spread out with a brush upon boards and allowed to dry. The sheets are only about 2 feet in length, but sometimes sheets 10 feet long are produced.

On all sides the question of finding substitutes for rags for paper making is acknowledged to be one of the most important. In Bavaria, according to a recently issued government report, the paper makers are directing earnest attention to the discovery of some substitute for rags, "and largely adopting wood, which has not tended to improve the paper; and they still desire to see the export duty re-established, as though the duties on paper under the new tariff may give them the home market, they are desirous of improving their paper and exporting to foreign countries."

Again, in a report from the Consul at Christiania, we read that the produce of wood pulp increased immensely during 1882, causing prices to fall considerably. Many mills were extended, and several new ones were erected during the year. Some of the mills established in 1881 only commenced working in the beginning of 1882, at a time when the sale of wood pulp is, as a rule, very limited. The manufacturers tried to force the sale of their produce, and thus large quantities were rather suddenly thrown upon the market, causing a considerable fall in prices. While the consumers in 1881 had to pay from £5 to £5 7s. 6d. per ton for wood pulp containing 50 per cent of water, delivered free on rail at Christiania, the average price at the close of 1882 only amounted to £3 10s.; and in the summer the best wood pulp was sold at even £3 5s. per ton. Manufacturers found it difficult to dispose of their large stocks, and as wet wood pulp could not be well preserved for a longer time considerable quantities were damaged, and sold as inferior goods at prices varying from £3 to £2 15s. per ton. In consequence of this many mills stopped working until their stock of pulp had sufficiently diminished. In November, 1882, a meeting of manufacturers was held in Christiania, when several subjects connected with the wood pulp industry were discussed. Thus it was proposed to restrict the produce, but no practical result in that direction was arrived at, except that a committee was elected for a further consideration of the matter. It seems that, while in 1875, 8,540,000 tons of wood pulp were exported, the quantity had risen in 1882 to 59,033,000 tons.

From Drammen the Vice-Consul also reported that the exportation of wood paper pulp showed a considerable increase. As only a very few mills, however, gave a reasonable profit, the owners were compelled to avoid all possible expense, and therefore a large proportion of the pulp was exported from Drammen direct, instead of *via* Christiania, in order to save the cost of railway carriage between those two places. Since all the paper pulp mills are situated along the railway line from Drammen up to Konigsberg and Randsfjord, the only reason for exporting the pulp by way of Christiania, and paying heavy railway charges, is the convenience which the regular lines of steamers from Christiania to the great places of import afford to shippers. A regular line of steamers from Drammen to a convenient port on the east coast of England ought to pay, especially if a reasonable return freight could be relied on.

In a report from Rome dated at the close of the past year, under the head of paper, it is stated that "this industry, for which considerable hydraulic force is necessary, meets, in the province of Rome, with the most favorable auspices, yet there are surprisingly few manufactories; indeed, there are only eighteen moved by 510 hydraulic horse power, and employing 347 men, 157 women, and 103 children. The production of paper is a little over 16,000 quintals (31,520 cwt.), though it might be at least 25,000 quintals (49,000 cwt.). The materials used for making it are rags of vegetable texture, and straw. A manufactory in Tivoli makes use of asbestos for the production of cardboard. At present the manufacture of paper in Italy exceeds the demand as to quantity, but not as to quality. The newspapers of Rome are printed on paper obtained from manufactories on the river Livi, distance about seventy-five English miles from Rome."

Among the most recent materials applied to paper making are the fibrous stems of the sugar cane after they have been passed through the mill, and the saccharine juice expressed; this, which is known as *bagasse*, has hitherto, in most cases, been used as fuel. In America, however, fuel of all kinds is cheap, so that in Louisiana, for instance, *bagasse* is seldom or never used for burning, and it is a worthless product, some planters, indeed, not knowing what to do with it. Recent experiments have shown that the hitherto useless *bagasse* contains a fiber that may be utilized for paper making. A ton of the material will yield about 650 pounds of fiber, while every ton of the latter can be converted into 1,500 pounds of pulp.

It has been estimated that each planter who makes 400 hogsheads of sugar might realize no small portion of his yearly expenses by working his *bagasse* and extracting its fiber. A company was formed in New Orleans about a year ago to make paper out of cane fiber. Their numerous experiments have satisfactorily ascertained that paper of an excellent quality can be made from this substance, and that the material is so inexpensive that it can be profitably worked. Certain planters have offered the company all the *bagasse* on their places for from five to ten years gratis. They hope to see this new industry started, so that they will be able to sell their *bagasse* to the factories. Others propose to extract the fiber themselves, for, if once paper factories are established, it will become a marketable product.—*John R. Jackson, Museum, Kew; The Gardeners' Chronicle.*

Manufacture of Porcelain at the Royal Works, Dresden.

These works are at Meissen, near Dresden. The china for ornamental pressing is not used in a clay state, but as a liquid, slip-like, thick cream. This is poured into the orifice of the mould left for the purpose, and then allowed to stand for a short time; when sufficient slip has adhered to the mould, the remainder is poured back into the casting jug. The slip having remained in the mould for some minutes becomes sufficiently solid to enable the workman to handle it. He next proceeds to arrange all the pieces on a slab of plaster before him. He then trims the superfluous clay from each, and applies some liquid slip to the parts, and so makes a perfect joint, each part being fitted to its proper place, until the whole figure is built up as it was before it was moulded; as each joint is made, the superfluous slip is removed with a camel's hair pencil.

The object is next propped with various strips of clay having exactly the same shrinkage and is then ready for the oven. The shrinkage, or contraction to which we have alluded is one of the most important changes, as well as one of the greatest difficulties encountered in the art of pottery. The change will be more or less, according to the materials used and the process employed in making. Thus, earthenware will not contract so much as porcelain, and a pressed piece will not contract so much as a cast one. The contractions are sufficiently well known to the modeler, and he makes allowance in the model accordingly, the design being fashioned so much larger than is actually required; the shrinkage from the original model to the finished object being sometimes equal to 25 per cent.

The ware up to this point in all the stages of manufacture we have described is most tender, and can only be handled with the greatest care.

The manufactured objects being now ready for baking, are taken to the placing house of the biscuit oven, where may be seen some hundreds of seggars of all shapes and sizes. These seggars, which are made of fire clay and are very strong, are the cases in which the ware is to be burned. Common brown wares, when the fire is comparatively easy, may be burned without any protection, as the fire or the smoke cannot injure them; but for porcelain or white earthenware these cases are necessary. The seggars are made of various shapes to suit the different wares. Flat round ones are used for plates, each china plate requiring its own seggar and its own bed in it, made of ground flint very carefully prepared, for the china plate will take the exact form made in the bed of flint. Cups and bowls are placed, a number of them together, in oval seggars, ranged on china rings to keep them straight. These rings must be properly covered with flint to prevent them adhering to the ware burned upon them. The seggars when full are piled one over the other most carefully in the oven, so as to allow the pressure to be equalized as much as possible; this is absolutely necessary, as when the oven is heated to a white heat (calculated as equal to about 25,000° Fah.) the least irregularity of bearing might cause a pile to topple on one side, and possibly affect the firing of the whole oven, causing a great amount of loss. Calcined flint is used for the purpose of making beds for the ware, because being pure silica it has no melting properties, and will not adhere to the china.

The form of oven seems to have been much the same in all ages, viz., that of a cone or a large beehive. A china oven is generally about 14 feet in diameter inside. It is built of firebricks, and is incased several times round with bands of iron to prevent too great expansion from the heat inside. There are generally eight fireplaces around the oven, with flues which lead directly into the oven in different directions. A china oven takes about forty hours to fire; it is then left to cool for about forty-eight hours. In order to test the burning, the fireman draws small test cups through holes in different parts of the oven made for the purpose. These tests show, both by contraction and the various degrees of translucency, the progress of the fire. The test holes are carefully stopped with bricks, so that cold air cannot be drawn into the oven.

The porcelain having been burnt is now in the state called biscuit; it is translucent and perfectly vitreous. Having had the flint rubbed off the surface and been carefully examined, it is sent into the dipping room.

The dipping room is supplied with large tubs of various glazes, suitable to the different kinds of ware. The glaze is really a kind of glass, which is chemically prepared of borax, lead, flint, etc., that when burned will adhere to the porcelain, and will not craze or crackle on the surface. This glaze is ground very fine (being on the mill for about ten days) until it assumes the consistency of cream. The process of glazing is simple, but requires a practiced hand, so that every piece may be equally glazed and the glaze itself equally distributed over the surface.

From the dipping room the ware is brought into the drying stove, where the glaze is dried on the ware. It is then taken by women into the trimming room, where any superfluous glaze is taken off, and defective places are made good. From this room it is taken to the glost oven placing house, where the greatest care and cleanliness are required, as should any dust or foreign substance get on the glaze it will adhere in the fire, and very likely spoil the piece.

The glost oven is of the same construction as the biscuit. It takes sixteen hours to fire, and the tests are made in the same manner as in the biscuit oven. The average heat is equal to about 11,000° Fah. In about thirty-six hours the oven will be sufficiently cool for the ware to be removed. It is then sent into the white warehouse, where it is sorted and given out to the painters and gilders, to be decorated according to the orders on the books.

Visitors generally look forward with pleasure to the mysteries of the decorating department. It is interesting to watch the painters, some on landscapes, others on birds, or flowers, or butterflies. All are interested in their work, which to the uninitiated may appear at first sight to be very unpromising, the colors being dull, and the drawing unfinished. As the work advances, it will be better understood. After the first "wash in" has been burned, and the painter has worked upon it for the second fire, the forms and finish, both in style and color, begin to appear.

The colors used are all made from metallic oxides; thus copper gives green and black; cobalt, blue; gold, purple; iron, red; etc.

The painters are trained from about fourteen years of age under special instructors; they thus acquire a facility of drawing and general manipulation of the colors which is found almost impossible to attain at a later period of life.

The gilding process is carried on in rooms adjacent to the painting. The elaborate and finely executed patterns in gold are all traced by the hand. The workmen require special training for this department also, correct drawing and clean finish being absolutely necessary. For the purpose of getting correct circles and speedy finish on circular pieces, a simple mechanical contrivance is used. A small table or stand with a revolving head receives the plate or saucer or cup, which is carefully centered so as to run truly. The time required for enamel kiln firing is about six hours. —*Pottery Gazette.*

ENGINEERING INVENTIONS.

Mr. De Witt C. Cumings, of Carthage, Jefferson County, N. Y., is the patentee of an improved counter shaft, including an independent short shaft in line with the counter shaft, intended to secure better alignment, do away with the ordinary loose pulley, and provide means for better lubrication.

A bearing for the spindles of amalgamating pans has been patented by Mr. Andrew Wallace, of Leadville, Col. The invention covers an improved contrivance of devices for centering and tightening the sliding jackets of the grinding mullers, with a spindle of angular or flat sided shape, on which the hollow space of the jacket fits, with adjusting wedges and screws for centering and tightening.

A car coupling has been patented by Mr. Hugh Graham, of Dartmouth, Nova Scotia, Canada. There are sliding blocks and springs in the sockets of the drawheads, to hold the links up level and to hold up the coupling pins for self-coupling, the blocks having spring latches so they may be easily set for holding up either the links or pins, with various other improvements, whereby the cars may be coupled or uncoupled without going between them.

A car coupling has been patented by Mr. Frederick E. Grothaus, of Boerne, Texas. Two coupling hooks are pivoted on a projection from the bottom of the car, passing through a guide slot, and connected with a vertically movable bar for raising them; the coupling hooks are raised and their free ends pressed together, and when released they swing downward and their free ends are separated to allow the hooks to catch on the front posts of the coupling box on the opposite car.

MECHANICAL INVENTIONS.

A turning machine has been patented by Mr. Albert T. Booth, of Meriden, Conn. This invention consists of a sliding tube in a revolving tube, the latter having a nipple on the end which contains a chuck fixed on the end of the sliding tube, and the sliding tube having bevel projections on its inner end, thus making an improved machine for turning metal or wood.

AGRICULTURAL INVENTIONS.

A hay stacker has been patented by Mr. John M. Coe, of Sloan, Iowa. This invention covers a novel construction and combination of parts to take hay from the ground, elevate it to the desired height, and then drop it upon the stack, to be stowed away by an attendant.

A rice drill has been patented by Mr. Arthur De L. Middleton, of Charleston, S. C. There are seed boxes outside of the wheels, so seeds can be planted along the edges of drains or ditches, all the seed boxes are provided with covers, and there are various novel devices and peculiarities of construction and arrangement.

MISCELLANEOUS INVENTIONS.

A wagon running gear has been patented by Messrs. John B. Spry and Thomas Barry, of Valparaiso, Ind. The invention covers some novel details in the construction and combination of parts, to increase the strength and durability of wagon gearings.

A portable folding parlor bowling alley has been patented by Mr. William M. Goodenough, of Newark, N. J. It is formed of a series of sections hinged or otherwise attached to each other, with a folding box at one end adapted to receive the balls that have been rolled at the pins.

A package and book holder has been patented by Mr. Charles Huff, of St. Louis, Mo. It consists of a combination of right angular wire frame, a spring frame pivoted thereto, a handle, cross piece, and rack, all making a convenient carrier and holder for books and packages.

A baling press has been patented by Mr. Simon P. Harbaugh, of Cumberland, Md. This invention consists of a novel construction whereby the baling of cotton, hay, and other substances is facilitated, and it may also serve as a platform scale to weigh the bales as they are discharged from the press.

A saw handle has been patented by Messrs. Rufus H. and William D. Shumway, of Lebanon Springs, N. Y. In combination with the handles of cross cut saws are plates made to form longitudinal grooves, cross grooves, and locking cavities, with a saw blade holding hook to engage with the walls of either of the cavities, with other novel features.

An ear corn feed regulator has been patented by Mr. Samuel E. Marsh, of Tarkio, Mo. It consists of pronged wheels and a discharging shelf arranged with the chute and hopper of an elevator carrying belt on the hopper of a storage crib, for feeding corn regularly to the buckets of the elevator, or from different sections of the crib.

A trace bearer for pad skirts has been patented by Mr. Simmons D. Taylor, of Carthage, N. Y. The bearer consists of an elongated loop or metal frame, by which the trace is prevented from wearing off the skirt, and the bearer will last longer than the usual trace bearer, which is facilitated by a special construction and arrangement of parts.

A saw table gauge has been patented by Mr. Henry L. Hopkins, of Caro, Mich. This is an attachment for scroll sawing machines, a parallel waved frame, with ways therefor, being secured to the sawing machine in a vertical plane nearly at right angles to the plane of the saw, and a saw table being pivoted in the parallel frame.

A propeller for small boats has been patented by Mr. John B. Kibler, of Minneapolis, Minn. A bottomless socket, with an upright post adjustably secured therein, is attached to the side of the boat, and this is made to sustain a paddle bar to be operated by a crank within the boat, by which the latter may be propelled in any desired direction.

A well bucket fixture has been patented by Mr. Frank L. Howell, of Neligh, Neb. This invention relates to sheet metal well buckets with a bottom ring supporting the valve, and the valve having a stem on its lower side for raising it, and the improvements cover improved construction and arrangement of the ring and valve.

A corkscrew has been patented by Mr. William E. Alvord, of Appleton, Wis. The corkscrew is formed on the lower end of a rod contained in an externally threaded tube, which in turn is contained in an internally threaded tube, the object being to so construct the corkscrew that the cork can be extracted without requiring the operator to pull on the corkscrew.

A friction clutch has been patented by Mr. William H. Rascoe, of Plattsburg, N. Y. In combination with a shaft is a loose wheel with recesses containing rollers, against which blocks rest, which are pressed by springs against the rollers, causing the rollers to bind on the wheel or shaft when the wheel revolves in one direction, but not when revolving in the reverse direction.

A refrigerator has been patented by Mr. Harvey W. Nash, of Amsterdam, N. Y. The ice box or crate, and other parts in the refrigerator, are so suspended that the water, condensing on such parts, as well as the drip water, cannot follow down the connections to dampen the walls of the refrigerator, thus rendering unnecessary the lining of the refrigerator with metal.

A magazine gun has been patented by Mr. Franklin J. Evans, of Iowa Falls, Iowa. The gun has a reciprocating breech block, with a lever pivoted thereto, and a stop bar in the breech cavity; there is also a lifting lever pivoted under the stop bar, with various other improvements, and the gun may also be used with single cartridges without employing the magazine.

A tailor's pressing machine has been patented by Mr. Edward Walker, of New York city. It is made with an ironing board mounted on a carriage adapted to run on a table, above which a smoothing iron is pivoted in a frame suspended from a weighted lever, which can be operated by a foot lever under the table, the double smoothing iron being heated by a gas pipe.

An adjustable trestle has been patented by Mr. Edward Owen, of Jackson, Tenn. It is for the use of carpenters, brick layers, and others, and has a slotted top bar and mortised longitudinal beam below and adapted to receive a frame, whose side bars have internal ratchet teeth, engaged by pawls pivoted to the longitudinal bar; this scaffold may be raised or lowered without interfering with the work.

A clasp for holding stockings, shirt sleeves, etc., has been patented by Messrs. Charles F. and William J. Walters, of Gang Mills, N. Y. It is formed of a U-shaped frame, with bends in the shanks, to the inner free ends of which a V-shaped frame is pivoted, adapted to be pressed between the shanks of the other. The same inventors have also patented a stocking supporter and garter, being a device for holding the stocking from a waist belt or corset or other article of clothing. An improved garter has likewise been patented by the same inventors, one which does not cut into the skin or bind on the same, does not tear the clothes, and holds the hose securely.

NEW BOOKS AND PUBLICATIONS.

BRICKS, TILES, AND TERRA COTTA. A Practical Treatise on the Manufacture. By Charles Thomas Davis. Henry Carey Baird & Co., Philadelphia. 8vo, 472 pp. Price $5.

This covers the manufacture of every important product of clay employed in architecture and engineering, with detailed descriptions of the most modern machines, tools, and appliances, including enameling in polychrome colors. The volume is illustrated by 228 engravings and 6 plates. Brick making is described as conducted in the most ancient times of which we have any record, while the modern processes are treated with the most ample detail, respecting the clays, the preparatory processes, moulding, and burning. The description of brick machines covers those which have been successful in general practice, and there are large views showing the arrangement of the machines, the brick cars, clay elevators, drying sheds, and kilns, in an extensive modern establishment. In the chapter on the enameling and glazing of bricks and tiles, it is stated that the colors now most used for architectural decorations in chromatic brick work are the same, with the exception of buff and brown, as those employed by the ancient Egyptians—red, yellow, blue, sometimes green, and white and black—and the use of oxides in making the modern colors is fully described. Mention is made of the best examples of terra cotta, and its employment and manufacture are treated in detail. Ornamental and art tiles conclude the volume, and of the latter the plates give beautiful illustrations of some of the finest American productions. The extensive and valuable character of this work will be better understood and appreciated by reference to the general contents of the book, which we publish in the advertising columns of our paper this week.

THE ART AGE. Arthur B. Turnure, editor and proprietor, 132 Nassau Street, New York city.

From the title of this new monthly the idea is conveyed that it is a publication probably devoted to paintings, etchings, engravings, etc., which it is not. It is a periodical intended for book collectors and persons having a taste for handsome printing and choice bindings. It is printed on superb paper, and the typography will gladden the heart of any artistic printer.

THE ART INTERCHANGE. Wm. Whitlock, No. 140 Nassau Street, New York city.

This journal, as its name implies, is devoted to decorative art. Every number contains illustrations and designs for persons learning or practicing the art of painting fans, decorating china, embroidering table covers, curtains, and other household articles. Each number contains recipes and directions for mixing and harmonizing colors. The *Art Interchange* fills a niche in journalism which is not overcrowded, and it should have a good patronage.

THE AMATEUR PHOTOGRAPHER, published by the Rochester, N. Y., Optical Company, is an excellent little monograph, admirably adapted for the guidance of beginners in the photographic art. The elaborate details involved in a complete study of photography are omitted, but it gives simple methods and processes whereby any individual of average intelligence can, with a very small outlay, quickly become proficient in taking landscapes, portraits, etc. The author has endeavored "to make photography simple and popular," and treats of his subject in a plain and practical way, from the manipulation of the instrument to the mounting of pictures.

REPRESENTATIVE LONDON JOURNALISTS is the title of a handsome lithograph recently issued by Messrs. Root & Tinker of New York. It is similar in design to a former picture of the same publishers, grouping the leading American journalists, and gives the editors of eleven of the best known London papers from the *Times* to *Punch*.

Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

Notice.—To Founders, Manufacturers of Stoves, Agricultural Implements, Machinery, Tools, Shovels, Saws, Files, Chains, etc.: We are in receipt of pamphlets which give full description of how the celebrated Connellsville Coke is made, embracing full instructions how to use it, names of the leading foundrymen using it, with their views and opinions; also a complete map of the Connellsville Coke region. These pamphlets will be sent, post paid, upon application to H. C. Frick Coke Company, Manufacturers of Connellsville Coke, Pittsburg, Pa.

Stephen's Vises. Special size for amateurs. See p. 13.

No fisherman wants his attention distracted or his patience tried by acrid, nauseating, narcotized tobacco. He wants something fragrant, mild, grateful, pure, inspiring. The tobacco for the fishing party is Blackwell's Durham Long Cut. It can't tantalize, but will insure comfort, patience, and a happy disposition.

For Steam and Power Pumping Machinery of Single and Duplex Pattern, embracing boiler feed, fire and low pressure pumps, independent condensing outfits, vacuum, hydraulic, artesian, and deep well pumps, air compressors, address Geo. F. Blake Mfg. Co., 44 Washington St., Boston; 97 Liberty St., N Y. Send for Catalogue.

Quinn's device for stopping leaks in boiler tubes. Address S. M. Co., South Newmarket, N. H.

Wanted.—Machine shop foreman used to first-class engine work. None except those who can give the best of references need apply. Address M. D. Leggett & Co., Cleveland, O.

Cyclone Steam Flue Cleaner saves Fuel, Labor, and Repairs ' Investigate." Crescent Mfg. Co., Cleveland, O

New and Second-hand Lathes, Drills, Planers, Engines, Shafting, etc. Bought, sold, and exchanged. A. G. Brooks, 261 N. 3d St., Philadelphia.

Hercules Water Wheel—most power for its size and highest average percentage from full to half Gate of any wheel. Every size tested and tables guaranteed. Send for catalogue, Holyoke Machine Co., Holyoke and Worcester, Mass.

If you want the best cushioned Helve Hammer in the world, send to Bradley & Company, Syracuse, N. Y.

Mills, Engines, and Boilers for all purposes and of every description. Send for circulars. Newell Universal Mill Co., 10 Barclay Street, N. Y.

Wanted.—Patented articles or machinery to manufacture and introduce. Lexington Mfg. Co., Lexington, Ky.

Brush Electric Arc Lights and Storage Batteries. Twenty thousand Arc Lights already sold. Our largest machine gives 65 Arc Lights with 45 horse power. Our Storage Battery is the only practical one in the market. Brush Electric Co., Cleveland, O.

For Freight and Passenger Elevators send to L. S. Graves & Son, Rochester, N.Y., or 46 Cortlandt St., N. Y.

"How to Keep Boilers Clean." Book sent *free* by James F. Hotchkiss, 86 John St., New York.

Stationary, Marine, Portable, and Locomotive Boilers a specialty. Lake Erie Boiler Works, Buffalo, N. Y.

Railway and Machine Shop Equipment.
Send for Monthly Machinery List
to the George Place Machinery Company,
121 Chambers and 103 Reade Streets, New York.

The Hyatt filters and methods guaranteed to render all kinds of turbid water pure and sparkling, at economical cost. The Newark Filtering Co., Newark, N. J.

Steam Boilers, Rotary Bleachers, Wrought Iron Turn Tables, Plate Iron Work. Tippett & Wood, Easton, Pa.

"The Sweetland Chuck." See ad. p. 296.

Iron Planer, Lathe, Drill, and other machine tools of modern design. New Haven Mfg. Co., New Haven, Conn.

For Power & Economy, Alcott's Turbine, Mt. Holly, N. J.

Electrical Alarms, Bells, Batteries. See Workshop Receipts, v. 3, $2.00. E. & F. N. Spon, 35 Murray St., N.Y.

If an invention has not been patented in the United States for more than one year, it may still be patented in Canada. Cost for Canadian patent, $40. Various other foreign patents may also be obtained. For instructions address Munn & Co., SCIENTIFIC AMERICAN Patent agency, 361 Broadway, New York.

Guild & Garrison's Steam Pump Works, Brooklyn, N. Y. Steam Pumping Machinery of every description. Send for catalogue.

Presses & Dies. Ferracute Mach. Co., Bridgeton, N. J.

Nickel Plating.—Sole manufacturers cast nickel anodes, pure nickel salts, polishing compositions, etc. Complete outfit for plating, etc. Hanson & Van Winkle, Newark, N. J., and 23 and 24 Liberty St., New York.

Supplement Catalogue.—Persons in pursuit of information on any special engineering, mechanical, or scientific subject, can have catalogue of contents of the SCIENTIFIC AMERICAN SUPPLEMENT sent to them free. The SUPPLEMENT contains lengthy articles embracing the whole range of engineering, mechanics, and physical science. Address Munn & Co., Publishers, New York.

Machinery for Light Manufacturing, on hand and built to order. E. E. Garvin & Co., 139 Center St., N. Y.

Curtis Pressure Regulator and Steam Trap. See p. 12.

Gear Cutting. Grant, 66 Beverly St., Boston.

We are sole manufacturers of the Fibrous Asbestos Removable Pipe and Boiler Coverings. We make pure asbestos goods of all kinds. The Chalmers-Spence Co., 419 East 8th Street, New York.

Steam Hammers, Improved Hydraulic Jacks, and Tube Expanders. R. Dudgeon, 24 Columbia St., New York.

Emerson's 1884 Book of Saws. New matter. 75,000. Free. Address Emerson, Smith & Co., Beaver Falls, Pa.

Hoisting Engines, Friction Clutch Pulleys, Cut-off Couplings. D. Frisbie & Co., Philadelphia, Pa.

Barrel, Keg, Hogshead, Stave Mach'y. See adv. p. 14.

Munson's Improved Portable Mills, Utica, N. Y.

Mineral Lands Prospected, Artesian Wells Bored, by Pa. Diamond Drill Co. Box 423, Pottsville, Pa. See p. 14.

Blacksmith Drilling Machines for ¾ to ⅝ inch diameter, $32.50. Pratt & Whitney Co., Hartford, Ct.

For best low price Planer and Matcher, and latest improved Sash, Door, and Blind Machinery, Send for catalogue to Rowley & Hermance, Williamsport, Pa.

Woodwork'g Mach'y. Rollstone Mach. Co. Adv., p. 13.

C. B. Rogers & Co., Norwich, Conn., Wood Working Machinery of every kind. See adv., page 286.

The Porter-Allen High Speed Steam Engine. Southwark Foundry & Mach. Co., 430 Washington Ave., Phil. Pa.

Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys. Yocom & Son's Shafting Works, Drinker St., Philadelphia, Pa.

Notes & Queries

HINTS TO CORRESPONDENTS.

Name and Address must accompany all letters, or no attention will be paid thereto. This is for our information, and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all, either by letter or mail, each must take his turn.

Special Information requests on matters of personal rather than general interest, and requests for **Prompt Answers by Letter**, should be accompanied with remittance of $1 to $5, according to the subject, as we cannot be expected to perform such service without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Minerals sent for examination should be distinctly marked or labeled.

(1) E. K. asks: Is a 5 volt incandescent electric lamp equal to 5 candle power? If not, how many candle power is it equal to? A. It would hardly be equal to 5 candle power. The construction of the lamp has much to do with its illuminating power. The exact equivalent of a volt in candle power cannot be stated.

(2) E. H. I. writes: I see in SCIENTIFIC AMERICAN SUPPLEMENT, No. 160, in giving directions for making an induction coil, it directs making the secondary coil in two sections. Will not one do just as well, or almost as well? A. When the coil is made in two sections, there is less danger of internal discharges. If you make your coil continuous, you will have to make the insulation very perfect and secure.

(3) E. V. D. asks: 1. What is the temperature of steam under pressure of one atmosphere, under two atmospheres, three, etc.?

A.	1 atmosphere	251°
	2 "	276°
	3 "	295°
	4 "	311°
	5 "	324°
	6 "	335°
	7 "	345°
	8 "	355°

2. Will "live steam" impart heat more quickly than steam as it is condensing? A. Live steam at high pressures only gives out heat by condensation, unless superheated. The word live only means steam from the boiler, as distinguished from steam from the exhaust.

(4) W. E. S. asks: In order to steer a boat clear of obstacles in a current (particularly in rapids) with which it is going and down which its course lies, is it necessary that there should be a propulsion of the boat independent of that which is caused by the current? In other words, in the case stated, is the rudder obeyed only when the boat is going (by means of steam or other independent agency) at a speed greater than that of the current? A. The boat must go faster (or slower) than the current to be able to influence its course by the rudder.

(5) J. F. P. asks, to settle an "argument," Which will most increase the power of a locomotive 16 inches diameter, 24 inches stroke—to add 1 inch to stroke or 1 inch to the diameter? A. One inch added to the stroke would add one-twenty-fourth to the power, and one inch added to diameter would increase the power one-eighth, or three times as much as adding one inch to the stroke.

(6) B. B. T. writes: We have two sets of boilers, 20 feet apart. No. 1 is 16 feet long, 48 inches diameter, and has twenty-four 5 inch tubes. No. 2 are two boilers connected by steam dome and mud drum, 24 feet long, 36 inches diameter, with two 13 inch flues. No. 1 furnishes more steam than we need for engine, and as we carry the same pressure on both sets could we connect by a pipe? If so, what size would you advise, and where connect it? A. You can connect them by a pipe not less than 4 inches diameter, but you must keep your safety valves, gauge cocks, etc., on both sets of boilers the same as if worked separately. There should also be stop valves in the steam pipes, outside the safety valve, so that either set of boilers can be shut off if necessary.

(7) A. C. asks a remedy for the roaring noise produced by the condensation of steam in cold water, the end of the pipe expanding into a coil. A. Have a drain cock at the end of the coil to draw off the condensed water, and not let the steam discharge into the tank, or preferably, place a false bottom across

the tank, with small holes, and place on top of the bottom 3 or 4 inches thickness of clean gravel; then discharge the steam below the bottom.

(8) A. S. asks: Will 12 spokes 6 inches wide, ½ inch thick, wheel 7 feet in diameter, sustain the weight of a traction engine weighing 7,000 pounds? 6 spokes are placed crosswise of the tire, 6 are placed wi h the tire, with a 14 inch tire. Will it be strong so as to drive the engine? A. We suppose you mean 12 spokes in each wheel; if so, we think they would be quite sufficient for the weight.

(9) T. D. B. asks: 1. How can I get the silver out of a gelatino-bromide emulsion which is turned sour and become as thin as water? A. Treat as described on page 4898 of SCIENTIFIC AMERICAN SUPPLEMENT, No. 307. That is, add salt solution, thereby obtaining silver chloride, this can be fused in a crucible with borax, giving rise to metallic silver. 2. Can the bichromate of potash solution which has been used in a battery, and of course contains a quantity of zinc, be put to any use, or can any salts be crystallized out, and if so what salts? A. Evaporate your solution till it becomes quite concentrated, when the potassium bichromate will crystallize out. 3. Can you explain how the current in a medical electric machine is produced when you connect one end of primary wire with one end of secondary? A. Your query is not quite specific enough. You may get only the extra current of primary, or both the current and the induced current from the secondary. 4. What use can old pyrogallic acid and ammonia developer be put to which has been used to develop plates and has not been kept in air tight bottle? A. They are of no further value; the ammonia has all volatilized, and it would hardly pay to attempt to work over the pyrogallic acid. 5. How can a dry plate be saved which has been exposed but not developed? I have heard they can be used by putting in a bath of something. A. We are not familiar with any process by means of which this object can be obtained. See the Photographic Notes, on page 275 of THE SCIENTIFIC AMERICAN for November 3, 1883.

(10) R. P. asks: 1. Which is the most constant, has the greatest electromotive force and least internal resistance—the Bunsen nitric or Bunsen chromic acid battery? A. Bunsen's nitric acid battery yields a current of 1·964 volts and Bunsen's chromic acid battery a current of 2·028 volts. The chromic acid battery is preferred on all accounts. 2. How many feet of No. 28 German silver wire would have a resistance of one ohm? A. You do not say whether your wire is measured by the American or English wire gauge. Probably about 15 inches of No. 28 by American wire gauge would measure 1 ohm, but a great deal depends upon the quality of the German silver. You should have a sample of your wire measured.

(11) B. S. asks: 1. What size boat and propeller wheel for an engine 2¼ bore and 4 inches stroke to obtain the best results? A. Boat 15 to 16 feet long by 3 feet wide and 16 to 18 inches deep. Screw 18 inches diameter by 27 inches or 28 inches pitch. 2. Speed I should get with 60 pounds of steam. A. If good model and plenty of steam, about 6½ miles to 7 per hour. Boiler should have 55 to 60 feet fire surface. 3. I would like to know the size wire that is used on spark coils such as are used for electric gas lighting. A. It depends something on the amount of work you intend to do with your coil. Probably No. 18 would answer your purpose.

(12) H. R. W. asks: 1. How much weight will an ordinary watch spring hold up when it is pulled out full length? A. Watch springs are tempered in coil, so on straightening out they would bear much less than the weight they would hold if tempered straight. It would probably be safe to estimate their breaking strain so straightened out as equal to at least 100,000 pounds per square inch of sectional area, but there are no figures as to this point. 2. Where can eucalyptus seed be obtained? A. For eucalyptus seed, address Department of Agriculture, Washington, D. C.

(13) C C. H. asks if a sample of serpentine inclosed would have any value, and the dimension of blocks that would be most desirable. A. Serpentine has been used occasionally for building purposes. We know of several churches built of this material that are much admired for their peculiar color and contrast. You might make arrangements through our architects for furnishing the serpentine for special work. A visit among architects with large samples would no doubt bring business to you. It is too soft for ornamental work except where it might take the place of gypsum or alabaster, with which it would make a fine contrast, as in polished vase work.

(14) H. P. T. asks: What is the cause of and remedy for discoloration of slate roof? The roof is something on the French style, topped out with a tin roof. Can it be rust or the paint used in painting the tin? It gives the slate an extremely bad appearance. Thinking it was iron rust, as the roof had been previously neglected, I tried acetic acid, etc., on the slate, but it had no apparent effect on it. A. Try oxalic acid 1 part, crystallized water 6 parts, by weight. Wash the slate with a swab and the acid, then wash with clean water. Oxalic acid is poison, and a powerful eradicator of stains.

(15) G. B. F. asks: Can you give some statistics regarding domestic and foreign manufacture of umbrellas and parasols, annual production, exports and imports? A. Umbrellas and canes were manufactured in 1880, in the United States, according to the census, to the value of $6,917,463. The exports of umbrellas, parasols, and sunshades for 1883 were $3,502. The value of imports in this line is not stated separately in the customs returns.

(16) H. R. W. writes: I have a small row boat, flat bottom and pointed at both ends, which I wish to run by steam. The boat is 18 feet long, 3½ wide, and about 2½ high. 1. What kind and size of engine do I need? A. Vertical inverted engine, 2¼ to 2¾ inch cylinder by 3 inch stroke. 2. How high a rate of speed can be attained by screw, and size of screw for such a boat? A. Probably about 6 miles an hour, with good boiler; screw 15 inches to 16 inches diameter. 3. Would coal or oil be the best fuel? A. Coal is the best.

(17) C. F. H. asks: What would be the cheapest and simplest plan to pump water into a tank, and if there is a hot air pump that is cheap and durable, also whether there is a windmill that lies down flat and can be covered with a roof? A. A hot air pump will probably be as cheap as and easier to manage than any other device except the windmill. We know of no windmills in the market that have a roof, or what are called horizontal mills. The best mills are those that stand square up to the breeze.

(18) E. A. H. says: The inside walls to the basement of my house are rough brick, and dampness from the earth outside comes through. Is there anything I can put on the walls to prevent it? A. Rake out all the joints and clean the wall thoroughly; then plaster it carefully half an inch thick with a mortar made of Portland cement one part, sand one part. To be applied in a dry time, when no water is coming through the wall. The mortar is held up by the wall, and any considerable thickness of mortar tends to drag itself off by its own weight. The more the mortar is worked into the joints, the better. The cellar bottom may be covered with same material, but should be two inches thick.

(19) W. R. C. writes: I have a small double engine with two 5 inch by 5 inch cylinders, with 24 inch driving pulley and 12 inch pulley on shafting. Will you give me the horse power, at 150 revolutions per minute, 80 pounds steam pressure? A. About 7½ horse power, allowing 60 pounds average pressure on the pistons. If there is an average pressure on the pistons of 80 pounds, the power will be about 10 horse power.

(20) J. G. J. asks: Please let me know through your correspondence column what speed could be attained from engine of the following dimensions, namely: 4 driving wheels, diameter 4 feet 10 inches, cylinder 15 inches, length of stroke 24 inches, steam pressure 140 pounds, pulling three coaches? A. Too many important particulars affecting the speed are omitted; an answer to the question as stated would be largely hypothetical.

(21) M. G. asks if there is a solution by which flies can be kept away from show windows and mirrors. A. Not that will have any permanent effect; their number can be reduced by using fly paper and various kinds of traps.

(22) J. M. J. asks: How can paint be removed from a boiler? I have tried muriatic acid, but it don't seem to have any effect. A. Take 1 pound American pearlash, 3 pounds quick stone lime; slake the lime in water, then add the pearlash, and make the whole about the consistency of paint. Apply this to the boiler, and allow it to remain on the paint for twelve hours. Three pounds of common washing soda dissolved in boiling water and applied hot by means of a common paint brush is said to soften paint in a very short while, so that it can be removed with a stiff scrubbing brush. A few ounces of potash added to the solution is said to increase its efficiency.

(23) F. A. K. asks: Can you tell us of any method by which the rust on the inner surface of tin cans can be covered up? We have had several things recommended, the latest of which is silicate of soda with an admixture of tin, but this does not give the exact color we want; it gives the cans the appearance of having been painted, which is the very thing we wish to avoid. A. We do not think that any method sufficiently cheap can be obtained. By dipping the cans in a bath of hydrochloric acid possibly some of the iron rust would be dissolved off, and at the same time a bright surface imparted to the cans. It would be most efficient if heated.

(24) G. W. C. asks: What is the sticky stuff called piping which is put in rubber overshoes? A. We presume you refer to the rubber cement used to close up openings. This consists of fine shreds of native India rubber, dissolved in good benzine free from oil.

(25) J. C. H. asks: Is there any cheap method by which asbestos felt can be made waterproof? That is, saturated completely and thus rendered impervious to water? Can this be done and the material still be at all pliable, or will it be rendered stiff? If the felt can be made waterproof in sheets, and boxes or tanks are desired to be made of it, what material should be used to cement the joint seams or corners? A. We think the following would accomplish your purpose. A mixture is prepared consisting of 60 parts of resin, 80 parts of tallow, 5 parts of wax, and 5 parts of turpentine. Soak the asbestos felt in this mixture, and it will become waterproof. Several processes for waterproofing cloth may be found in the SCIENTIFIC AMERICAN SUPPLEMENT, No. 317, which will afford you some information on this subject. This lining cannot be cemented, but only joined by same or similar material; we should think asbestos not a very suitable material for tank lining.

(26) J. H. N. says: It is stated that there is a process for eliminating the methyl from the alcohol in methylated alcohol, but it is very expensive. Can you give me that process? I have already tried a great many processes, but they have not been attended with sufficiently satisfactory results. A. For the purification of impure alcohols there are principally three methods. First, that of L. Naudin by electrolyzation. This process is described with illustrations in SCIENTIFIC AMERICAN SUPPLEMENT, No. 343. Secondly the method of Raoul Pictet by cold and by vacuum, which with illustrations can be found in SCIENTIFIC AMERICAN SUPPLEMENT No. 299; and finally the method by Eiseman. A report descriptive of these methods is given in SCIENTIFIC AMERICAN SUPPLEMENT, No. 338. Alcohol can sometimes be purified by rectifying over fused acetate of soda; from four to six drachms are sufficient for every gallon. The salt can easily be used over again after being purified by solution in water, filtering through charcoal, evaporating, and fusing.

(27) W. J. C. asks: Does the glazing of the granite ware which is now so extensively used for teapots, water pails, etc., contain lead? And if so, is there any danger of lead poison from it? A. Certain of the enamels contain arsenic, others lead, some tin, etc., so that some may be considered safe while others are dangerous. Lead poisoning is somewhat a matter of personal constitution.

(28) C. M. Co. ask the recipe for Lea & Perrin's sauce. A. The following is said to be the recipe. Mix together 1½ gallons white wine vinegar, 1 gallon walnut catsup, 1 gallon mushroom catsup, ½ gallon Maderia wine, ½ gallon Canton soy, 2½ pounds moist sugar, 19 ounces salt, 9 ounces powdered capsicum, 1¼ ounces each of pimento and coriander, 1¼ ounces chutney, ¾ ounce each of cloves, mace, and cinnamon, and 6¼ drachms assafoetida dissolved in one pint brandy, 20 above proof. Boil 2 pounds hogs' liver for twelve hours in 1 gallon water, adding water as required to keep up the quantity; then mix the boiled liver thoroughly with the water; strain it through a coarse sieve. Add this to the sauce.

(29) G. P. asks about the process of printing in gold leaf or metal in practice among the manufacturers of gentlemen's neck wear. A. Brass stamps of suitable device are used. The spots to be impressed are coated with the white of eggs and gold leaf spread over the locality, then the stamps are heated and pressed on the material; after which the surplus gold leaf is easily rubbed off.

(30) A. T. McI. asks: Can you inform me o any liquid chemical preparation that after having been applied to paper will remain invisible for a period limited from about three to four minutes, and then become visible and remain so? A. By writing with a solution of silver nitrate and then exposing the same to the ordinary action of light, that is sun light, it will become dark and remain so. The silver nitrate must be preserved in a dark place, and it is kept in a colored bottle as a usual thing.

(31) A. T. S. asks how to make the magnesium wire or sheet. A. Commercial magnesium is prepared by reducing magnesium chloride, or the double chloride of magnesium and sodium or potassium with sodium. The double chloride is prepared by dissolving magnesium carbonate in hydrochloric acid, adding an equivalent quantity of sodium or potassium chloride, evaporating to dryness, and fusing the residue. This product, heated with sodium in a wrought iron crucible, yields metallic magnesium containing certain impurities from which it may be freed by distillation. This process is now carried out on a manufacturing scale, and the magnesium is drawn out into wire or formed into ribbon for burning.

(32) G. R. L. asks for a receipt for transparent cement, such as used to repair glass and fine china. A. Canada balsam thinned with a little turpentine, benzol, or ether is the cement used in joining transparent glass, such as lenses, etc. See also SCIENTIFIC AMERICAN SUPPLEMENT, No. 158, for various kinds of cement.

(33) L. W. W. asks: How can tar be separated from the water coming from a tower scrubber at a gas works? The tar is of a very light quality, it being so light that some of it floats on top of the water and is lost. A. Most of the tar will sink, and that which floats is so slight in quantity that we do not think it will pay to attempt to save it; possibly, however, by stirring it with heavier tar from the hydraulic main it will be collected and sink with it.

(34) J. F. L. asks for a receipt for removing the gloss of diagonal cloth. A. We do not suppose this can be satisfactorily accomplished on a hard finished cloth; steaming is sometimes tried, but the effect is only slight and not permanent.

(35) L. S. asks for a formula for a stain, and method of applying same, that will make a good imitation of red cedar, on elm or other light colored woods. A. Either of the following will probably answer: 1. Boil ½ pound madder and ¼ pound fustic in 1 gallon water; brush over the work, when boiling hot, until properly stained. 2. The surface of the wood being quite smooth, brush over with a weak solution of aquafortis, ½ ounce to the pint, then finish with the following: Put 4½ ounces dragon's blood and 1 ounce soda, both well bruised, to 3 pints spirits of wine, let it stand in a warm place, shake frequently, strain, and lay on with a soft brush, repeating until of proper color; polish with linseed oil or varnish.

(36) A. F. L. asks for the cost of the St. Louis Bridge, and also of the Brooklyn Bridge. A. The St. Louis Bridge cost $6,537,000. Brooklyn Bridge cost in round numbers, $15,500,000. These amounts include the approaches, but do not include interest. With interest added up to date of completion, the cost of the Brooklyn Bridge was about $21,000,000.

(37) C. W. G. asks (1) for a No. 1 polish for wood. One that will remove specks, and fill up to some extent scratches, etc., and that would polish and dry quickly. A. Gum shellac 3 ounces, gum mastic 1 ounce, gum sandarac 3 ounces, alcohol 40 ounces. Dissolve the last two in the alcohol, then dissolve the shellac and pour off the clear for use. Filling composition consists of size and whiting brought to the consistency of putty. 2. A good zinc polish (fluid), one that will clean and polish quickly and is lasting. A. Use glycerine or creosote mixed with dilute sulphuric acid; hydrochloric acid diluted may also be used. 3. A good fluid for polishing and cleaning the copper drains for glasses used in saloons, they being wet continually, and hard to keep bright. A. Copper can be cleaned by using old nitric acid diluted, or use soft stone and rotten stone, made into a stiff paste with water and dissolved by gently simmering in a water bath. Rub on with a woolen rag and polish with dry whiting and rotten stone. 4. The best plating fluid for silver and nickel, without the battery. A. See answer to query No. 28, in the SCIENTIFIC AMERICAN for May 24, 1884.

(38) H. G. asks if there is any simple way of treating cord and rope so they will not rot when exposed to the weather. A. Immerse the cordage in a solution of 50 or 60 parts water and one part mercuric chloride (corrosive sublimate). This is said to preserve it from decay. We believe that standing rope is frequently treated with tar for a similar purpose, and an application of tallow is said to be beneficial for running rope.

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